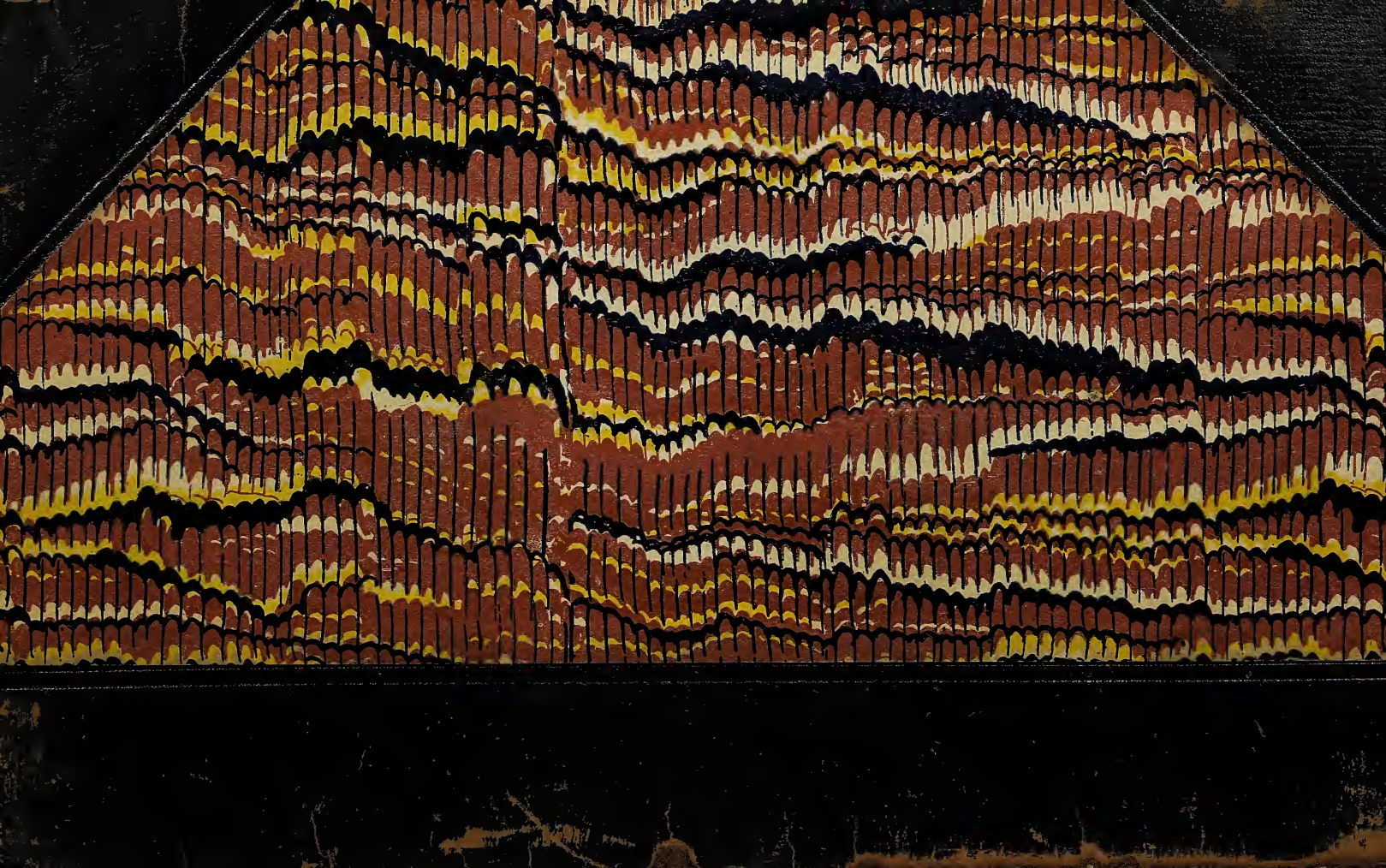

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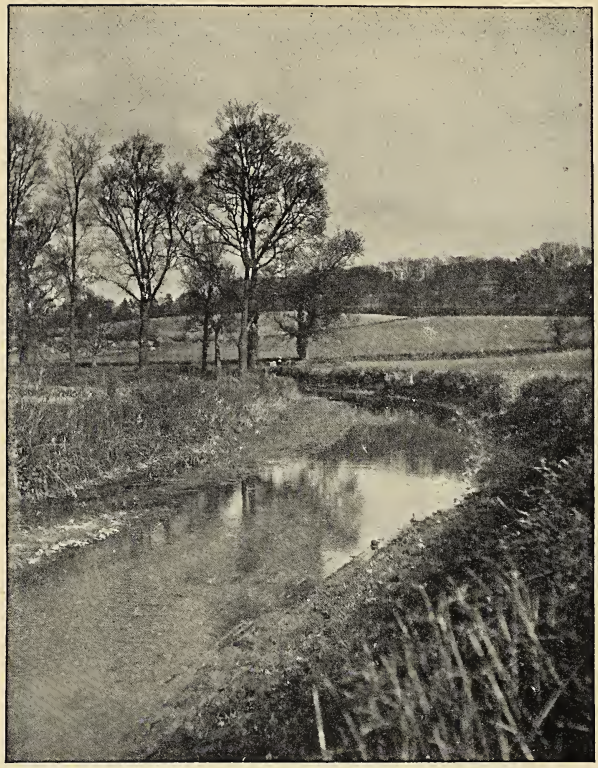
VOL. XII.



The Lane up the Valley of the Bourne, in April, 1904.

Gravel-pit in the Bourne Valley, in April, 1904.

TRANSACTIONS

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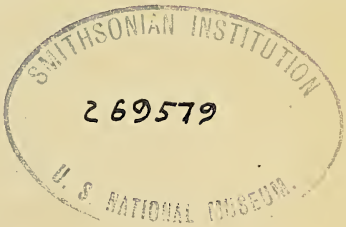

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TRANSACTIONS

OF THE

HERTFORDSHIRE NATURAL HISTORY SOCIETY.

I.

ADDRESS.

SUN-DIALS AND THEIR MOTTOES.

By the President, Lewis Evans, F.S.A., F.R.A.S.

Delivered at the Anniversary Meeting at Watford, 24th March, 1903.

Ladies and Gentlemen,—

In addressing you this evening on the subject of Sun-dials I have no intention of going into either the astronomical or the mathematical aspect of dialling: for such matters you may refer to some of the five hundred or so books which have been printed on this art; and I know that you will appreciate my forbearance when you see the size of a volume which explains the art of dialling in a fairly comprehensive manner. It measures 16½ inches by 11 inches by 3 inches, and weighs twelve pounds; and its name is '*Ars magna lucis et umbræ*' (The Great Art of Light and Shade), by Athanasius Kircher, 2nd ed., Amsterdam, 1671. All books on the subject are not of such vast bulk, and I have here the first book on dialling published in this country: '*Horologiographia*' (The Art of Dialling), by Thomas Fale, 1593. This, however, is the second edition, 1626. Besides that, I have a copy of the first book on dialling ever printed: '*Compositio Horologiorum, in plano, muro, truncis, anulo, concavo, cylindro & variis quadrantibus, cum signorum zodiaci & diversarum horarum inscriptionibus : autore Sebast. Munstero*,' Basle, 1531, 4to; and also the last English book on dials: 'The Book of Sun-dials,' 4th ed., 1900.

Nothing is known as to the first invention of sun-dials, but it seems probable that they originated in Chaldæa or Babylonia. There is little doubt that Berosus of Chaldæa (not the historian

of that name) brought the knowledge of the Shadow-pointer and of the division of the day into twelve parts, to the Greeks, and that he settled in Cos about B.C. 640 and imparted this and other astronomical knowledge to Thales of Miletus, who handed it on to Anaximander.

The earliest recorded sun-dial (if indeed it was a dial) is that of Ahaz, about 700 B.C. (2 Kings, xx, 11; Isaiah, xxxviii, 8): "And Isaiah the prophet cried unto the Lord: and he brought the shadow ten degrees backward, by which it had gone down

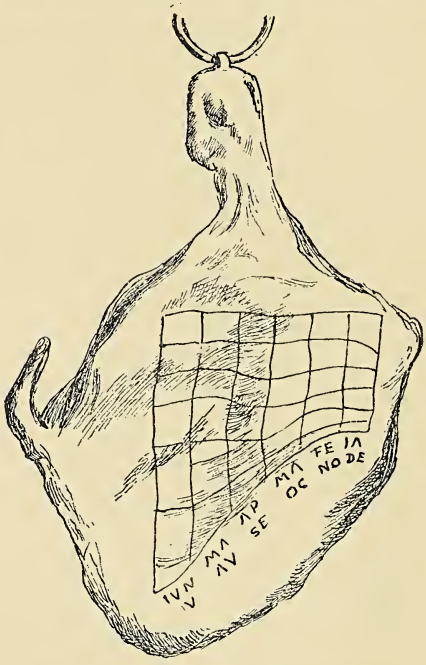


FIG. 1.—Roman Dial from Herculaneum.

in the dial of Ahaz." In connection with this it is noticeable that the Babylonians had great influence in Judæa during the reign of Ahaz.

There are a good many Greek and Roman sun-dials preserved in museums in this and other countries, dating from as early as about 300 B.C. These dials were usually made by hollowing a hemispherical recess, or often half a hemisphere, in a block of stone, fixing a metal pointer terminating at the centre of the sphere, and tracing the hour-lines on the curved surface; but some other varieties have been discovered, and many more are mentioned

by the Roman writer Vitruvius in his 'Architecture,' which was probably written in the first century. Most of these classical dials showed the unequal hours, that is to say, the day and night were each divided into twelve, the day hours being long in Summer and short in Winter; at the same time the mathematicians quite understood that the division into hours at the time of the equinox, when the day and night were equal, was the scientific way of dividing the day, and two or three ancient dials exist which show these hours only.

Probably the art of dialling was never completely lost during the dark ages which followed the decay of Rome, but no dials are known to exist which belong to that period.

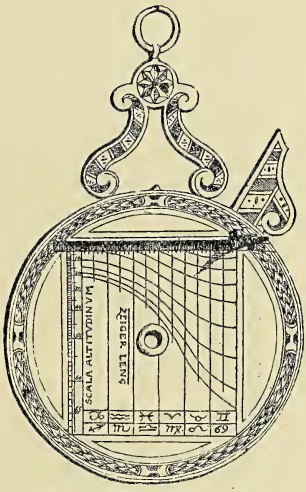


Fig. 2.—German Dial.

The earliest dated Saxon dial in this country stands in the churchyard of Bewcastle in Cumberland; it is on a cross the shaft of which still remains with inscriptions on it recording that it was a sign of victory put up in the first year of King Ecgfrith, that is, A.D. 670. From that date we have had an unbroken succession of dials and dial-makers until the present day.

I wish, however, this evening to tell you something about portable and pocket dials, of which I have brought several examples to show you; and if there is time I should like to mention a few sun-dial mottoes.

There is no doubt that the first time-recorder that men used when travelling was their own shadow. Palladius, in his '*De re rusticâ*,' written in the fifth century, gives a table of the

shadow-lengths for the hours of the day at different times of the year, and quotes from Theodosius (about A.D. 100) as follows:—"To find the time it is necessary to measure your own shadow by moving forward foot before foot to the end of the shadow of your head." This method of finding the time was a very old one, and one of the earliest allusions to it is found in Aristophanes, who, writing about B.C. 430, in one of his plays talks of "a ten-foot shadow" in connection with the time of day.

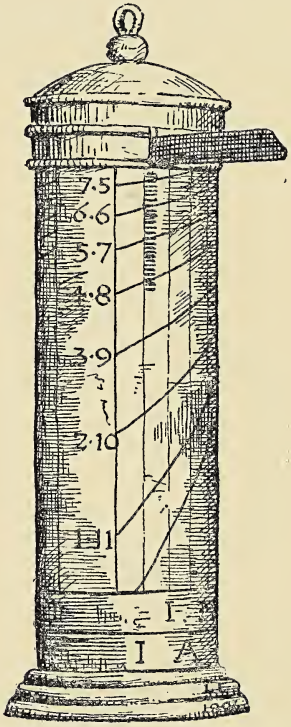


FIG. 3.—English Cylinder Dial.

One objection to this method was that, although there was ample difference in the length of the shadows near sunrise and sunset, towards noon the difference was very small; but in the earliest Roman portable dial this is rather less noticeable, as the shadow of a projecting arm is allowed to fall on a vertical plate, so that the variation in the length of the shadow is considerable even at noon. The dial in question, which is now in the Museum at Naples, is fashioned to resemble a ham (Fig. 1, p. 2); it was found in the

excavations at Herculaneum, a city overwhelmed by an eruption of Vesuvius, A.D. 79. It was most likely made very shortly before that date. A German dial (Fig. 2, p. 3) dated 1612 exactly illustrates the principle of this Herculaneum dial: the instrument is held up by its ring, the projecting arm being fixed opposite the space marked with the name of the month, and when the arm is pointed towards the sun its shadow gives the hour. On the back of this instrument is a "nocturnal" or night dial, about which I shall speak later on.

This same method was adopted in the cylinder, a form of dial much used in Europe in the Middle Ages; it was mentioned in English manuscripts as early as the thirteenth century, and it is still used in the Pyrenees. In the cylinder dials the projecting arm is fixed in a kind of stopper, which has to be turned until the

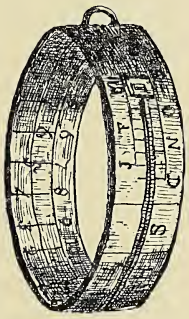


FIG. 4.—Brass Ring Dial. England.

arm is over the proper month-space. One of the two cylinder-dials exhibited (Fig. 3, p. 4) is English, about 1770, and the other was bought in the Pyrenees last year. The gilt brass disc made to resemble an astrolabe shows this type of dial in another shape; it was made about 1570 in Germany.

Another form of dial, which in its action depends on the height of the sun above the horizon, is the ring-dial, in which a ray of sunlight is allowed to pass through a hole pierced in the side of the ring so as to fall on hour-lines engraved within the ring. I am exhibiting two English ring-dials, one a silver finger-ring made about 1620, and the other (Fig. 4) a larger brass ring of about 1760.

Many other devices were employed for telling the time from the sun's altitude, as will be seen from the gilt brass hanging dial and calendar, "Nathaniell Torporley inventor," 1593; the Gunter's

quadrant, about 1650; the German dial shaped like an ancient ship (Fig. 5), about 1480; the rectangular brass plate with a dial on one

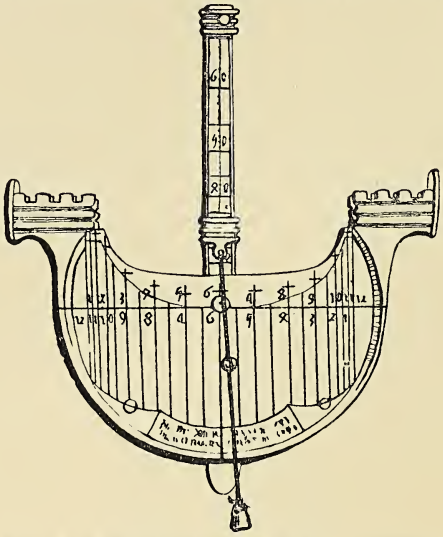


Fig. 5.—Dial in the form of a Ship. Germany.

side and a calendar on the other, made by Schindler, 1716; and the French quadrant and nocturnal dial, dated 1543. The illustration

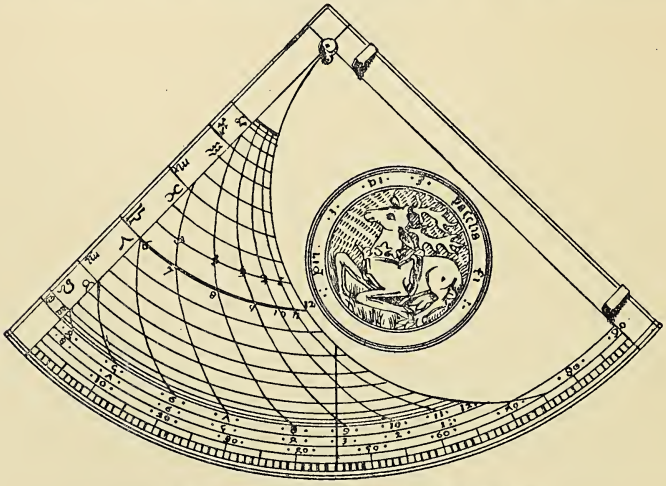


Fig. 6.—Brass Quadrant made for Richard II.

(Fig. 6) shows a brass quadrant, now in the British Museum, which was made for King Richard II in 1399.

The next dial that I wish to bring to your notice is a Roman one in my collection which has many points of interest about it. In the

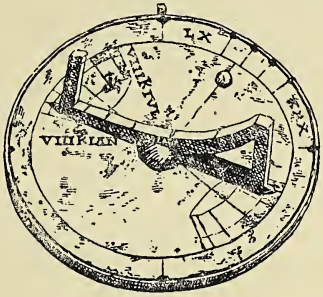


Fig. 7.—Roman Dial.

first place, so far as I can learn, only four portable dials made in classical times have ever been discovered: the Herculaneum

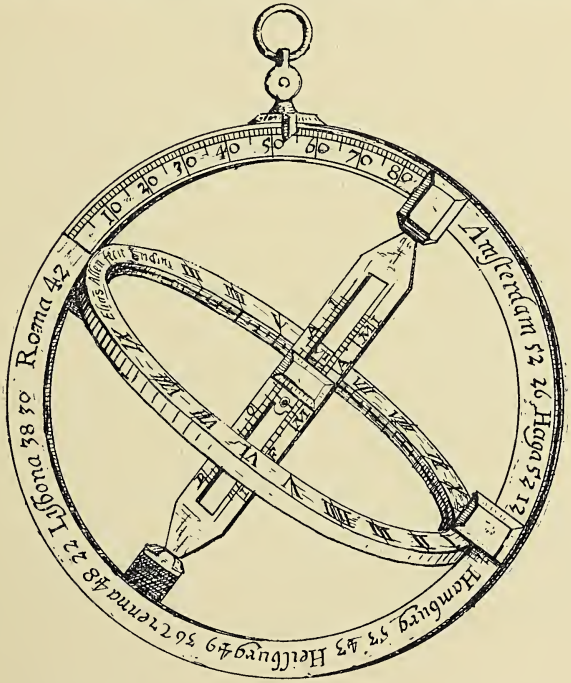


Fig. 8.—Universal Ring Dial.

"ham"-dial, a bronze disc found at Aquileia, a dial found at Cortona about 1741, and the dial here represented (Fig. 7).

Secondly, this instrument exhibits a knowledge of astronomy much in advance of anything traceable in all the other Greek and Roman dials which have been found. Thirdly, this is the only one of the four Roman portable dials which remains absolutely perfect and uninjured. And fourthly, it shows the equinoctial hours such as those by which we now reckon. It was found in Austria, and was probably made about A.D. 250–300. On its back are engraved the

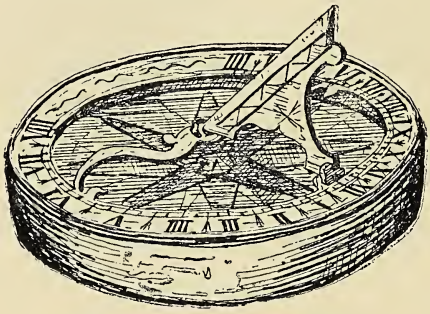


FIG. 9.—English Compass Dial.

names and latitudes of many Roman provinces, and it can be used in any latitude. Its method is essentially the same as that of the universal ring-dial, of which I exhibit several specimens this evening: an English one (Fig. 8, p. 7) made by Elias Allen of London, about 1630, one made by J. A. Pfeiffer at Coburg about 1720, and another German one mounted on a stand beside a large English dial about 1730. This is one of the best and most

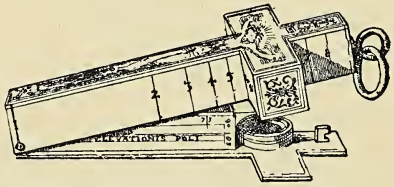


FIG. 10.—German Crucifix Dial.

convenient forms of pocket-dials: the time is shown by a ray of light falling on the centre line of the hour-ring. In use the hour-circle is turned on its pivots until it stands square to the meridian ring, the slider in the middle bar is set to the name of the month, and the suspension-ring being set to the latitude of the place, the dial is held by the ring and turned so that a spot of sunlight shining through the slider falls on the centre line

of the hour-circle and shows the time. It is necessary that the observer should know whether it is before or after noon when using this dial, or any of the others which I have mentioned; this being known, the dial not only shows the hour, but the cross-bar

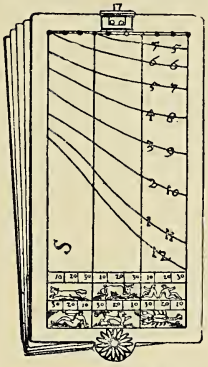


Fig. 11.—Gilt Brass Tablet Covers.

points to the pole, the hour-circle lies parallel to the plane of the equator, and the outer ring points north and south.

About the thirteenth century the mariners' compass came into use in Europe, and was at once used in connection with sun-dials.

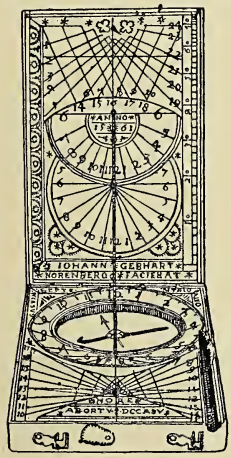


Fig. 12.—Ivory Dial, 1561.

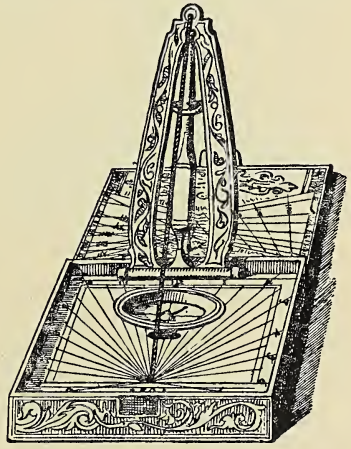


Fig. 13.—Gilt Brass Dial by V. S., 1570.

The most common English form was a round metal box containing a compass with an ordinary horizontal dial above it, the gnomon being hinged so as to take less room; this type has remained unaltered to the present time, besides the one illustrated (Fig. 9, p. 8),

which was made about 1730. I have a silver dial of this type, which is interesting from the inscription on it: "Made by C. Harrison in his 85th year, his gift of love to his Grandaughter Rosetta Hughes, 1810."

I have amongst other English dials with compasses a folding wooden dial, made about 1650; a nicely-made brass dial by Edmund Culpeper, about 1690; a very fine instrument by Tho. Wright, maker to His Majesty, 1730–1750, having on it an Earl's coat of arms with the motto "*Memini*"; and lastly, a very pretty gilt brass block with nine dials on it, which was made by Nicolas Kratzer at Oxford for Cardinal Wolsey. It bears on one side the

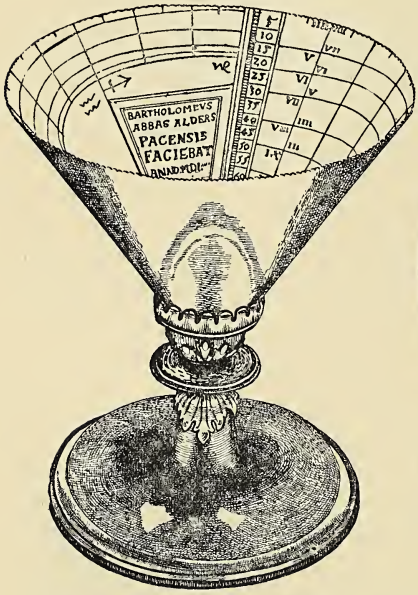


Fig. 14.—German Chalice Dial.

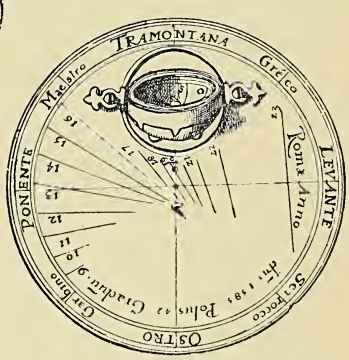


Fig. 15.—Italian disc-shaped Dial.

arms of Wolsey, and on the other those of the cathedral church of York; it also has on it a Cardinal's hat twice repeated. This dial must have been made some time between 1518 and 1530. It is fully described in vol. lvii of 'Archæologia.'

It would, of course, be quite impossible for me this evening to give a description of the many varieties of dials exhibited, but I would call your attention to the large number of German dials amongst them, and to the fact that the saying "Nuremberg's hand goes through every land" was especially true as regards dials, Augsburg's "hand" also being well represented.

I should like you especially to notice the dial in the shape of a cross (Fig 10, p. 8), made by M. P. (Marcus Purman of Munich) in 1596; the gilt brass tablet covers (Fig. 11, p. 9); the ivory folding dial (Fig. 12, p. 9), made by Johann Gebhart of Nuremberg in 1561; the gilt brass folding dial (Fig. 13, p. 9), made by V. S. (Ulric Schneip of Munich) in 1570; the German gilt brass chalice dial, dated 1550 (Fig. 14, p. 10), which is now in the British Museum; the gilt brass disc-shaped dial with a compass (Fig. 15, p. 10), which was made in Rome in 1585, and shows the Italian hours, which are reckoned from sunset to sunset; the silver Japanese dial (Figs. 16, 17); the very pretty dial of silver and black enamel (Fig. 18, p. 16), which was made by Macquart of Paris about 150 years ago; and the French watch, made by Gribelin of Blois about 1610, with a sun-dial in its case. The size of this may perhaps remind you of Captain Cuttle's watch, thus described by Dickens: "The Captain pulled up the silver watch,

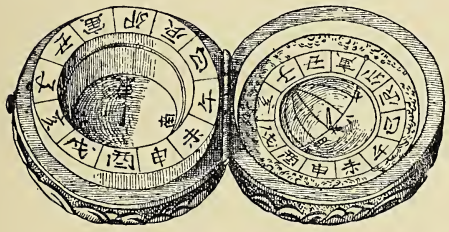


Fig. 16.—Japanese Silver Dial (open).

Fig. 17.—Japanese Silver Dial (closed).

which was so big, and so tight in his pocket, that it came out like a bung." Perhaps it also resembled that watch in its going powers, as the Captain said, "Put it back half an hour every morning, and about another quarter towards the arternoon, and it's a watch that'll do you credit"; if so, the maker was a wise man when he added a sun-dial to it, as a stand-by.

There is also a very pretty little tortoise-shell and silver dial made by Charles Bloud of Dieppe, about 1660, for Maria Theresa, daughter of Philip IV of Spain and wife of the "*Grand Monarque*," Louis XIV. The dial has an escutcheon engraved on it bearing the arms of France and Spain.

Before passing on to sun-dial mottoes I may explain the nocturnal or star-dials to which I have alluded. These usually consisted of three plates held together by a rivet with a sight-hole up its centre; the larger or handle plate had a circle on it divided into months and days; the second plate, which was smaller than this

circle, was divided into hours with a projecting notch at 12 o'clock midnight; this notch had to be set to the day of the month. The observer then held the instrument towards the north, keeping the handle at the bottom and looking at the pole-star through the central hole of the rivet, and turned the last plate or index-arm until it touched the pointers of the Great Bear, when it recorded the hour of the night on the smaller disc. There are two eighteenth century nocturnals here, one English and one German, besides the nocturnals combined with various sun-dials.

I will now conclude by mentioning a few only out of the 2,000 dial mottoes that have been collected, and of which nearly three-fourths are printed in the last edition of Mrs. Gatty's book; these mottoes are taken almost at random, except that all those on the dials here to-night will be cited, and that I have omitted all the most common mottoes.

1. "Abuse me not, I do no ill;
I stand to serve thee with good will:
As careful, then, be sure thou be
To serve thy God as I serve thee."
Formerly at Oldham.

2. "Aspice quam celeri cursu levis effugit hora."
Mark with how swift a course the light hour flies.

3. "Avant de regarder si je suis juste,
Regarde si tu l'est toi-même."
Before thou lookest if I am right,
Look if thou art right thyself.
At Laon.

4. "By light from heaven I mark how days do die;
How rise again at morning-tide I mark.
When clouds obscure that light, I patiently
Stretch my dumb gnomon, hopeful in the dark,
Waiting to catch once more some guiding heavenly spark.
To die, to rise, to hope in time of trial,
Take, master, thus thy lessons from the dial!"
By the Rev. J. T. Jeffcock, 1861.

5. "C'est l'heure de boire."
Now is the time for drinking.
On an inn at Libourne, etc.

6. "Hora bibendi."

Inch House, Midlothian; near Grenoble, etc.

7. "Cogitavi dies antiquos, et annos æternos in mente habui."

I have considered the days of old and the years that are past (Psalm lxxvii, 5). On a brass pocket-dial (German) in my collection, together with

"Vigilate, quia nescitis diem neque horam."

Watch, for ye know neither the day nor the hour (St. Matthew, xxv, 13). This also appears on a gilt brass Spanish dial I have, which is dated 1562.

8. "Cras, inquis faciam; concessaque labitur hora.
Fac hodie, fugit hæc non reditura dies."

To-morrow thou sayest, I will do it; and the past hour glides away.
Act to-day, for this day flies never to return.

Given in a MS. by Widmann, Freiburg, 1760.

9. "Curriculum meum perficiam donec advenerit Dominus."

I will perform my course until the Lord shall come.

On a gilt brass portable dial resembling an astrolabe which was made in Germany about 1580 and is now in my collection.

10. "eX hoC oMnIs DeCor eXVrget."
"sVb haC VMbra DatVr seCVra qVIes."

Hence will all grace arise. Under this shade is given quiet rest.

These two mottoes are on a brass folding dial ornamented with a bishop's mitre and crozier, which I am exhibiting, and each line forms a chronogram for the year 1726, that is to say, the Roman numerical letters occurring in each, when added together, make 1726.

The honestone dial next to it has another of these chronogram mottoes:—

11. "HI qVI hoC teMpore bene VtentVr
GaVDIIs CœLI perenne frVentVr."

Those who their time here well employ
Shall Heaven's eternal bliss enjoy.

The two lines in this case give the date 1785.

12. "SIngVLIs horIs LaVDetVr IesVs SaLVator noster ab oMnI CreatVra."

Every hour by every creature let Jesus our Saviour be praised.

1785 is the date of the chronogram.

13. The silvered and gilt casket-shaped dial, which is of Italian make, and a very uncommon and perhaps unique type of dial, has several mottoes inscribed on the scrolls around the silver boy figures, the boys' hands serving as gnomons for the five dials.

On the east is: "A solis ortu usque ad meridiem intervalla ipsa diei æque denuncio." From sunrise till noon I announce at equal periods the divisions of the day.

On the south: "Vespere cum eis pariter et mane in eodem diei ostendere non deferam." In the evening and the morning, like the others, I shall not delay to tell my tale.

On the west: "(A) meridie usque ad solis occasum itaque cum illa gradior." Like the last, my steps I take from noon to sunset.

On the north: "Expecto donec inveniat illuminatio mea, ut cum aliis inservire valeam." I await the coming of my light, that with the others I may be strong to serve.

The motto on the horizontal dial upon the lid was lost when I bought the casket, so, on behalf of the boy figures, I have added: "Opera manuum nostrarum dirige super nos" (Prosper thou the works of our hands upon us: Psalm xc, 17, Prayer-book version).

This was a presentation instrument made at Naples in 1770.

14. "Fais ce que dois, advienne que pourra;
L'heure est à Dieu, l'espérance à tous."

Do what thou oughtest, come what may;
The hour belongs to God, hope to all.

The second line of this motto, as well as "Adèle Essex, 1896," is round a sun-dial at Cassiobury, the letters being made of box on a double ring of gravel 30 feet in diameter.

The pretty ivory dial which folds into the shape of a book was made by Hans Troschel of Nuremberg about 1610, and has on it:

15. "Hora fugit, mors venit."
Time passes, death advances.

16. "If o'er the dial glides a shade, redeem
The time; for, lo, it passes like a dream.
But if 't is all a blank, then mark the loss
Of hours unblest by shadows from the cross."

Written by the Rev. R. W. Essington, and inscribed on a dial in the form of a cross at Shenstone, near Lichfield, 1848.

17. "Irrevocabilis labitur hora,
Nulli optabilis dabitur mora.
Ne sis inutilis semper labora,
Ne tu sis futilis, vigila, ora."

Never returning, hours glide away;
Thou, though much yearning, canst not delay.
Labouring, learning, spend thou thy day;
Indolence spurning, watch thou and pray.

Written by the Rev. S. E. Bartleet, and paraphrased in English by Sir Herbert Maxwell.

18. "Nil nomen nil fama juvat nil candida virtus:
Tempus enim rapido singula dente vorat."

Nor valour bright, nor name, nor fame can aid,
For time's swift tooth makes each of these to fade.

On a brass concave dial made by Hieronimus Vulpariæ, Florence, 1588, in my collection.

19. "Parta tueri,"

and the chronogram, "DVCI aVgVsto gVILheLMo," for 1722, are on a silver dial with a compass and folding gnomon in my collection. The motto may be translated: "Stick to what you've got."

20. "Præteritum nihil,
Præsens instabile,
Futurum incertum."

The past is nothing, the present unstable, the future uncertain.

On an English dial, about 1698.

21. "Set me right—use me well—and I—time tell."

On a brass ring-dial made by Proctor about 1760.

22. "Transit umbra, lux permanet."

Shadows pass, light remains.

On an ivory portable dial made by Hans Ducher of Nuremberg, in 1578, are the following:—

23. "Wenn Gott wil, so ist das recht zil."

When God so wills, that is the rightful term.

"Der Spöter sol nichts verachten
Den er kans besser machen."

The scorner should not despise anything, unless he can do better himself.

24. " With warning hand I mark time's rapid flight
From life's glad morning to its solemn night;
Yet, through the dear God's love, I also show
There 's light above me by the shade below."
By John Greenleaf Whittier.

25. " Alle die ir Hoffnung stellen auf Got,
Verlest Er nicht in keiner Not.
In allen thun und lassen dein
Las Got dein Ent und Anfang sein."
All who their hopes on God do stake,
In direst need He won't forsake.
In all thou dost, or leav'st undone,
Place, then, thy trust on God alone.

26. " Mors venit, hora fugit, metuas mortem venientem.
Quælibet est index funeris hora tui."
Death comes, the hour flies, fear thou the approach of death.
Any hour is the signal for thy death.

On an ivory dial in my collection which was made by Hans Ducher of Nuremberg, 1580.

In conclusion I will quote the motto on Barnes Church, which in its literal sense gives a sufficient cause for me to stop:

27. " The night cometh."

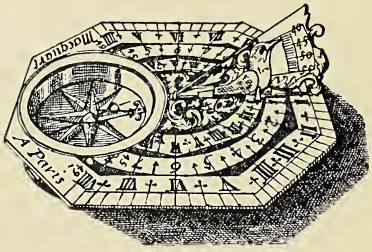


Fig. 18.—French Silver Dial.

II.

ON SOME FOSSILIFEROUS POST-TERTIARY BEDS EXPOSED AT THE GAS WORKS, WATFORD.

By T. E. Lones, M.A., LL.D., B.Sc.

Read at Watford, 24th February, 1903.

The opportunity of examining fossiliferous beds of Post-Tertiary age in the western part of the county so rarely occurs that the following account of beds of this kind existing in the Colne Valley will probably be of interest.

During the early part of the year 1902 a deep excavation, to receive a new gasometer, was made at the Watford Gas Works; and in consequence of a suggestion made by Mr. Daniel Hill, this excavation was visited by members of this Society during a field meeting last May, under the direction of Mr. John Hopkinson.

The accompanying section represents the beds exposed in an excavation made near the northern side of the site for the new gasometer, and has been drawn to scale from measurements taken on the spot. The direction of the section was nearly W.N.W. and E.S.E. The beds exposed were as follows:—1, made ground (not shown in the illustration), 5 ft. 11 ins.; 2, original soil, 4 ins.; 3, stiff clay, 1 ft. 9 ins.; 4, highly plastic clay, 1 ft. 8 ins.; 5, gravel and sand, (about) 4 ft. 6 ins. The underlying Chalk (6) was not exposed in the section, but its approximate depth was ascertained from Mr. A. H. Godwin, the Manager of the Watford Gas Company.

The upper part of the section showed a mass of made ground, dating from about the year 1886, the original soil being visible as a dark band beneath it. Below this original soil is a bed of stiff clay, which is reddish-brown, except towards the lower part, where it becomes darker, and, finally, nearly black. In the lower parts of this clay, near the eastern branch of the river, were found many horns and portions of the skulls of oxen, fragments of skulls, a leg-bone, and several cervical vertebræ of horses, and part of the lower jaw of a pig. Some of these bones were found very close to the river.

A bed of highly plastic clay of a French grey colour lies beneath the stiff clay, and contains many land and fresh-water shells, all of existing species. The colour and the highly plastic nature of the clay clearly indicate that it has been derived from denuded Reading Beds. It is very nearly horizontal, and shows only slight variations in thickness. I was informed at the Gas Works that during levelling operations carried out there it had been found that the top of the clay was as nearly as possible horizontal in a northerly and southerly direction. In an easterly and westerly direction there are slight changes in dip, apart from apparent changes in dip due to variations in thickness of the clay.

Below the light-coloured clay is a mass of gravel and sand resting upon the eroded upper surface of the Chalk. The gravel

and sand consist mainly of coarse and sharp sand, unworn flints, and flint-pebbles, and contain numerous white quartz-pebbles, a few quartzite-pebbles, and some irregular masses of peat. A small piece of bone, a splinter probably from a leg-bone, was found by me in one of these masses of peat, but the bone was too small for determination of the species of animal to which it belonged. The following is a list of Mollusca found in the light-coloured clay, the species having been determined by Mr. E. T. Newton, F.R.S., of the Geological Survey:—*Helix arbustorum*, *H. caperata*, *H. nemoralis*, *Bithynia tentaculata*, *Pisidium amnicum*, *Limnæa peræger*, *L. palustris*, *Succinea putris*, *Planorbis carinatus*, *P. vortex*.

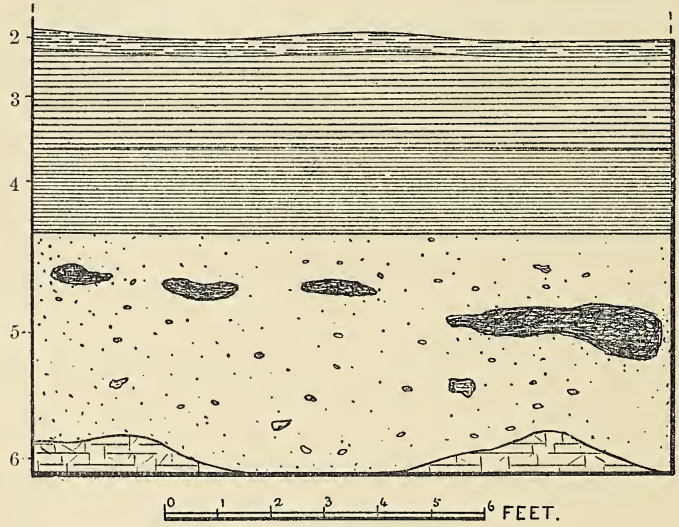


Fig. 19.—Section at the Gas Works, Watford.

Having described the beds themselves, we may next enquire how far they enable us to theorize on the physical conditions of the Colne Valley at the periods during which they were deposited. For this purpose, the most interesting are the fossiliferous beds marked 4 and 5 in the section. It is generally admitted that at a period very recent, geologically speaking, but very ancient from an ordinary point of view, the climate of this country was very much colder than it is now, and that most, if not all, parts of England north of the Thames Valley were covered by ice and snow. During this period extensive deposits of clay, gravel, and sand, containing materials transported from a distance, were laid down beneath or near the icy coverings. These and other deposits formed by various agencies during this cold or glacial period are commonly known as glacial deposits or drift.

To what extent ice and snow occurred over England is one which admits of considerable differences of opinion, and it would be out of place, as well as unnecessary, to discuss this interesting question here. The main fact to which I particularly wish to draw attention is that at a period far distant from the present the climate of this country, and, therefore, of the Colne Valley, was very cold, and, in all probability, beds of gravel, sand, and clay, containing flint-pebbles, unworn flints, and pebbles of quartz and quartzite such as occur in bed No. 5, were laid down in the Colne Valley during the cold period. Let it be assumed, therefore, that at or about the close of the so-called glacial period in the Colne Valley, beds of the kind just described existed there. This assumption would enable us at once to account for the immediate origin of the materials of which bed No. 5 is composed. The general appearance of this bed, its masses of peat, and its occurrence at the lower part of a well-defined river-valley, clearly indicate that it was formed partly or wholly by river-action. It may, in fact, be reasonably concluded that the original drift was disturbed and redistributed by the action of a river running through the ancient representative of the present valley of the Colne. Whether the high grounds on each side of the valley were higher relatively to the river than they are now is difficult to ascertain, but it seems most likely that they were. The rainfall, however, was probably much greater, and the climate colder. All these conditions would help to form a river having a volume larger than that of the Colne, a faster current, and what is much more important from our point of view, subject to violent floods after heavy rainstorms and the melting of snow and ice in the Spring. This river, especially during floods, transported the drifts and redeposited them, at the same time tearing away masses of vegetation growing in its shallowest parts, or on and near its banks, and mingling them with the redeposited materials as indicated by the occurrence of masses of peat in bed No. 5.

I have been informed by Mr. E. H. Jackson, until lately a member of this Society, that several years ago some masses of peat were found in or close to Water Lane, at the part near the main railway. This peat occurred in beds very similar, so far as my information goes, to those of the Gas Works, and from the occurrence of such deposits and others in various parts of the Colne Valley between the railway and Bushey Mill Lane, it would seem that the ancient river of the Colne Valley underwent changes in its course.

The nearly horizontal position of bed No. 4, the extreme fineness of the muddy material from which it was formed, and the presence therein of many unbroken but very fragile shells, clearly indicate that the clay was quietly deposited from flood-waters which spread over a fairly level tract of the gravel and sand on either side of the ancient river, or situated between its branches, such as may be seen to-day along the valley of the Colne. As previously stated, this clay was, no doubt, derived from the neighbouring Reading Beds.

The bed of clay No. 3, the materials of which cannot be so easily

traced to their parent deposits, was laid down, in all probability, under conditions very similar to those under which bed No. 4 was deposited. It is very probable that during the time which elapsed between the redistribution of the drifts so as to form bed No. 5, and the deposition of the upper part of bed No. 3, the ancient river was gradually cutting its way deeper and deeper into the valley, and, in consequence of a diminution in the rainfall, becoming less powerful and less subject to violent floods.

This may be regarded as a general account of the probable physical history in recent geological times of that part of the Colne Valley which lies between Watford and Bushey Mill Lane.

III.

NOTES ON LEPIDOPTERA OBSERVED IN HERTFORDSHIRE IN THE YEAR 1902.

By Philip J. Barraud, F.E.S.

Read at Watford, 21st April, 1903.

In the absence of Mr. A. E. Gibbs, your Recorder of Insecta, who, I regret to say, has been seriously ill, I have been asked to lay before the members of the Society the annual report on the Lepidoptera observed in this County during the past year.

In addition to notes made by Mr. Gibbs, Mr. Arthur Cottam (of Watford), and myself, I have received reports from Miss Alice Dickinson, of the New Farm, St. Albans, and Mr. A. T. Goodson, of Tring.

Owing to the cold and unfavourable Summer the season was not a good one from an entomologist's point of view, but in spite of this some good captures were made, and I am glad to say that we are able to add six species to the County list, bringing the total up to 1,149.

These species are:—

Phycis fusca (*carbonariella*), taken by Mr. Gibbs at Bricket Wood in September.

Tinea albipunctella, captured by Mr. Gibbs at St. Albans in June.

Tinea fuscipunctella, taken by Mr. Gibbs at the same place in June and October.

Coleophora annulatella (*laripennella*), taken by Mr. Gibbs at St. Albans in August.

Laverna miscella, captured at Aldbury by Mr. Gibbs in September.

Camptogramma fluviata, a specimen of which was taken by Mr. Goodson at Tring Reservoirs on 21st September, 1898, but has only recently been identified by the Hon. N. C. Rothschild.

Mr. Goodson says that so far as his collecting was concerned the season was fairly remunerative. Butterflies were certainly not so common as in the previous year, especially the Blues and Fritillaries, but the latter have of late years been more or less scarce. Early in the year he met with the usual Hyberniidæ, and bred some *Eriogaster lanestris* and *Amphidasys prodromaria*. In April the sallows yielded *Tæniocampa gothica*, *T. instabilis*, *T. cruda* (*pulverulenta*), *Pachnobia rubricosa*, *Cerastis vaccinii*, *Scopelosoma satellitia*, and *Eupithecia abbreviata*.

On April 13th a specimen of the large tortoise-shell butterfly (*Vanessa polychloros*) was captured at sallow-bloom near Stubbings Wood by Mr. W. Hawker Smith. This appears to be the first record for this insect so far west in the county, and brings the total number of butterflies observed in the Tring district up to 40.

On April 16th Mr. Goodson bred *Asphalia ridens* from larvæ beaten in Wick Wood, and on the 25th some *Demas coryli*. On

the 29th of the same month *Tephrosia consonaria* was found to be fairly common on tree-trunks. The first specimen of *Syrichthus malvæ* in the Tring district was seen on the 11th May; and during the month *Nisoniades tages*, *Thecla rubi*, *Euchloë cardamines*, *Lycæna argiolus*, *Euclidia mi*, *Pyrausta purpuralis*, and *Adela viridella* were observed on the wing, and *Smerinthus tiliæ*, *Lophopteryx camelina*, *Ephyra linearia*, and *Cerura vinula* were bred, the last-named from ova on aspen.

For June Mr. Goodson records the following species:—*Lycæna adonis* (this was also taken by Mr. Cottam and myself in the Tring district), *L. icarus*, *L. astrarche* (*agestis*), *Hesperia sylvanus*, *Strenia clathrata*, *Cidaria suffumata*, *Phibalapteryx vitalbata*, *Coremia ferrugata*, *Bapta temerata*, *B. taminata*, and *Lithosia sororcula* (*aureola*) (beaten in Wick Wood on the 10th). The last two appear to be new to the Tring list.

In this month Mr. Goodson bred *Chærocampa porcellus* from larvæ found at Aldbury Nowers in 1901, and *Hylophila bicolorana* appeared in his breeding-cases on 17th July from larvæ taken in Wick Wood. On the same day *Leucania straminea* and *Cymatophora ocularis* were taken at sugar at Wilstone Reservoirs (the Hon. N. C. Rothschild very kindly assisting in getting access to the desired spots). On the 18th the following came to sugar at the same place:—*Leucania straminea*, *L. conigera*, *L. impura*, *Miana arcuosa*, *Acronycta megacephala*, *Apamea leucostigma*, *Hecatera serena*, and others; and *Timandra amataria* at dusk and light. July 23rd, at sugar, *Mania maura*, *Leucania straminea*, *Orthosia upsilon*, *Miana literosa*, etc. July 25th, *Bombyx quercus*, bred from larvæ taken almost in Tring town; *Euplexia lucipara* and *Acidalia virgularia*, on walls, etc. July 27th, a specimen of *Tronchilium crabroniformis* (hornet clearwing of the osier) was found on an old willow-tree near Startop's End Reservoir. July 28th, *Plusia iota*, *Melanthia ocellata*, *Melanippe rivata*, etc., at dusk at the Holloways, and *Ebulea crocealis*, disturbed from grass at Wilstone Reservoir, where larvæ of *Cerura vinula* were common on willows.

Lycæna corydon was common near Tring in August, and a large percentage of the specimens seen were dwarfs, some of them being only half the size of the usual form. The second brood of *Lycæna alsus* (*minima*) was noticed, but not that of *Lycæna adonis*. *Hesperia comma* appeared in about its usual numbers. Of the Heterocera the best taken were *Leucoma salicis* (bred), *Zeuzera pyrina*, *Charæas graminis*, *Luperina cespitis*, *Eupithecia subfulvata*, *Pyrausta purpuralis*, and *Eunychia nigrata*.

September brought the following moths:—*Hepialus sylvanus*, *Luperina cespitis*, *Neuronia popularis*, *Nonagria cannæ* (*arundinis*), *Calamia lutosa*, *Catocala nupta*, *Agrotis suffusa*, *Xanthia flavago*, *Noctua rubi*, *Phibalapteryx lignata* (*vittata*). Butterflies were scarce, but *Colias edusa* (with var. *helice*) and *Vanessa cardui* were captured. In October *Thera juniperata*, *Oporabia dilutata* (abundant), and *Ennomos quercinaria* (*angularia*) were the only species met with.

At ivy-blossom in November the usual species were taken, and *Orthosia macilenta*, which is an addition to the Tring list. *Pœciliocampa populi* was bred and taken at light.

One interesting point Mr. Goodson noticed with regard to the season was the erratic appearance of many species, good specimens being obtained long after the usual date of appearance. This was no doubt due to the inclement weather, which would delay the appearance of these species.

Mr. Goodson completes his report by stating that he has taken the following species in the Tring district which have not previously been recorded from that part of the county:—*Hepialus velleda*, *Cilix glaucata*, *Thyatira derasa*, *T. batis*, *Hadena protea*, *Tæniocampa gracilis*, *T. munda*, *Dianthecia conspersa* (*nana*), *D. cucubali*, *Agrotis saucia*, *Noctua umbrosa*, *Rusina tenebrosa*, *Chariclea umbra* (*marginata*), *Hydræcia micacea*, *Apamea ophiogramma*, *A. unanimis*, *Miana bicoloria*, *Zanclognatha grisealis* (*nemoralis*), *Z. tarsipennalis*, *Hypena rostralis*, *H. proboscidalis*, *Eupithecia absinthiata*, *E. vulgata*, *Eucosmia certata*, *Thera variata*, *Cidaria silaceata*, *Anticlea rubidata*, *Melanippe unangulata*, *M. procellata*, *Coremia designata*, *Macaria liturata*, *Pericallia syringaria*, and *Herbula cespitalis*.

Miss Dickinson is again able to furnish notes on some interesting species. One large tortoise-shell (*Vanessa polychloros*) was seen on April 19th; and several painted ladies (*Vanessa cardui*) in the Spring and also in August. *Lycæna argiolus* was seen so late as September 22nd, *Euchloë cardamines* so late as July 8th, and a freshly emerged *Gonopteryx rhamni* on September 25th. *Epinephile hyperanthus* is still common at Symonds Hyde, although it has quite disappeared from Batch Wood. Very few hair-streaks were seen by Miss Dickinson, in fact only *Thecla quercus*, but her brother saw a number of what she thinks must have been *Thecla w-album* on July 14th on a Spanish chestnut tree in Batch Wood. Although she visited the spot for several days afterwards not one was to be seen. Among the larvæ collected and reared by her were:—*Smerinthus populi*, *S. tiliæ*, *Notodonta ziczac*, *N. camelina*, *Asteroscopus sphinx*, *Triphæna fimbria*, *Cucullia verbasci* (on white mullein in Batch Wood), and *Trichiura cratægi*. Some larvæ of the last-named, together with two *Lasiocampa quercifolia*, were sent to her from Sandridge; and larvæ from *Acherontia atropos* were seen in potato-fields near St. Albans.

Miss Dickinson, in common with other entomologists, was not very successful with sugar. Amongst some of the commoner species she took three *Gonoptera libatrix*, and saw many *Catocala nupta*. The latter was also observed commonly on telegraph-posts in September and October.

Mr. Arthur Cottam paid several visits to Wippendell Woods, and took the following, amongst others:—*Bapta taminata*, May 19th; *Drepana lacertula* and *Lithosia aureola*, May 26th; *Tortrix ministrana* and *Ephippiphora trigeminana*, June 3rd. He also obtained several good species at light at Bushey, viz.:—*Hadena genistæ*, *Smerinthus ocellatus*, *Dianthecia cucubali*, *Neuria reticulata*

(*sapponaria*). At Watford *Plusia moneta* appeared in some numbers, and several species were taken at light, including *Rhodophora formosa*.

With regard to notes made by myself, the first white butterfly was seen April 14th, and a specimen of the peacock butterfly (*Vanessa io*) on the 21st of that month. I paid several visits to Aldbury Down, near Tring. *Lycæna adonis* (*bellargus*) males were fairly plentiful there on June 27th, and *L. corydon* swarmed in August. One specimen only of *L. astrarche* was seen, two *Epinephile hyperanthus*, two *Hesperia comma*, males; while *Epinephile tithonus* and *Lycæna alsus* (*minima*) were out in numbers. On August 4th I was pleased to find *Hesperia thaumas* in small numbers at Aldbury Down, for although I have collected there occasionally for several years I have never before met with this species. The Heterocera found in that locality were *Zygæna filipendulæ*, *Eubolia limitata*, *E. bipunctaria*, and one *Carposcapsa grossana* beaten from beech.

I was rather more successful with sugar than some of my friends, but my captures were by no means numerous. Several visits to Bricket Wood with Mr. S. H. Spencer, jun., of Watford, only yielded *Asphalia diluta* (common), *Amphipyra pyramidea*, *Polia flavicincta* (one), and *Catocala nupta*; but in my garden at Bushey Heath, where I usually sugar an apple-tree and damson-tree, I noticed, among others, *Agrotis suffusa* (common), *Noctua plecta*, *Triphæna fimbria* (two), *Amphipyra pyramidea*, *Mania maura*, *Xanthia citrago*, *Hadena protea*, and *Hypena rostralis*. *Plusia moneta* appeared in some numbers at Bushey Heath in July and August.

By far the larger number of my captures, however, were made at "light," by which means I secured over 220 species during the year. I give below a list of some of the most interesting. Those marked * are new to my list for Bushey Heath.

Sphinges
- Smerinthus populi *

Bombyces
- Odonestis potatoria
- Lasiocampa quercifolia
- Drepana falcula
- D. hamula
- Pterostoma palpina
- Notodonta dictæoides *

Noctuæ
- Xylophasia lithoxylea
- Dipterygia pinastri
- Neuronia popularis
- Luperina cespitis
- Miana fasciuncula
- M. bicolor
- M. arcuosa
- Agrotis puta (also at sugar)
- A. porphyrea
- Noctua triangulum
- N. brunnea *
- Calymnia pyralina
- C. diffinis
- Cleoceris viminalis *
- Aplecta nebulosa *
- Hadena thalassina
- Cucullia umbratica *
- Habrostola tripartita
- Plusia chrysitis
- P. iota
- P. moneta (also at dusk)

Geometræ
- Ellopia prosapiaria *
- Eurymene dolobraria *
- Selenia lunaria
- S. illustraria, var. æstiva *
- Ennomos erosaria
- Pseudoterpna cytisaria *
- Asthena luteata *
- Acidalia dilutaria *
- A. imitaria
- Timandra amataria

Macaria liturata *
Emmelesia alchemillata *
Eupithecia pulchellata
E. centaureata
E. subfulvata
E. castigata *
E. subnotata
E. assimilata *
E. sobrinata *
E. rectangulata
Cidaria pyraliata
C. associata
Pelurga comitata
Eubolia plumbaria

DELTOIDES

Zanclognatha tarsipennalis
Z. grisealis

PYRALIDES

Pyralis farinalis
P. glaucinalis
Aglossa pinguinalis *

PLICATÆ

Scoparia mercurella *

CRAMBI

Crambus geniculeus *

PHYCITIDÆ

Phycita roborella *
Salebria betulæ *
S. formosa *
Hypochalcia ahenella *
Eurhodope advenella *
Euzophera pinguis *
Ephestia elutella *
Aphomia sociella

TORTRICES

Tortrix unifasciana * (dark form of female)
Dictyopteryx lœflingiana
D. bergmanniana *
Penthina betulætana
P. ochroleucana
P. cynosbana *
Spilonota ocellana *
S. rosæcolana *
S. roborana
Sericoris urticana *
Carposcapsa splendidana *
Xanthosetia zoegana
X. hamana
Yponomeuta vigintipunctatus *
Y. cagnatellus *
Phibalocera quercana *
Depressaria flavella *
Œcophora pseudospretella *

IV.

A REVIEW OF HERTFORDSHIRE ORNITHOLOGY.

By William Bickerton.

Read at Watford, 24th February, 1903.

Although the Watford Natural History Society was formed in January, 1875, there appears to have been no systematic attempt at collecting, recording, and classifying information on the birds of the county until the end of 1877. Stray notes on birds were, however, brought before the notice of the members, and specimens of rare, or at any rate uncommon species were exhibited at the meetings. Doubtless these casual and incidental references to the subject gradually evolved in the minds of those members of the old Society who were interested in the study of birds the desire to approach this study on more systematic and scientific lines, so as not only to lay before the members some serious results of their labours, but also to establish the facts relating to the avifauna of our county in the general records of British ornithology.

The first paper on Hertfordshire ornithology was read on the 8th November, 1877, by the late Mr. J. E. Littleboy, and was entitled "The Birds of our District." The district referred to was that of Hunton Bridge and King's Langley, but casual observations on the birds of some other portions of the county were included. Appended to the paper was a first list, duly classified, of 92 recorded species. A further list of 17 very uncommon birds, shot apparently between the years 1840 and 1850, and preserved at Munden House, was added, together with a third list of 10 rare birds observed near Hitchin, and a fourth list of 2 birds only, shot at South End near Redbourn. The total number of species in these four lists is 121, but as four of the species occur in more than one list, the actual number of separate species recorded is 117. These lists form the first really scientific contribution to the ornithology of the county, and it is upon them as a foundation that the work of subsequent observers has been based.

At the succeeding meeting of the Society, held on the 13th December, 1877, it was formally decided to keep an official register of the birds of the county, and naturally Mr. Littleboy was appointed as first recorder of birds for the Society. This important office he filled for a period of ten years, 1878–87.

Upon his death in the latter year, Mr. John Hopkinson, F.L.S., temporarily undertook the work, and he in turn was succeeded by Mr. George Rooper, F.Z.S., 1889–90, Mr. Henry Lewis, 1891–94, and Mr. A. F. Crossman, F.L.S., 1895–1901. Early in 1902 I undertook the duties of Recorder in succession to Mr. Crossman, but I am afraid that the zealous and indefatigable labours of my predecessors have left me very little to do in the way of recording species new to the county.

It would naturally be expected that during those early years in which the register of birds was being prepared, there must have been a large number of new records to make, every bird when first recorded, however common, being for the purposes of registration new to the county. And thus it comes about that during the first ten years, 1878–87, the fine total of 200 species was placed on the register. Up to 1884, when the register included 164 species, Mr. Littleboy had added no birds to his list whose presence in the county had not been well authenticated since the date at which the register was opened, i.e. 1877. In 1885, however, he decided to open his register to all well-authenticated records of Hertfordshire birds, irrespective of date, and thanks mainly to a list of 20 species supplied to him by the Hon. Walter Rothschild as having been recorded at the Tring Reservoirs, the number rose from 164 in 1884 to 200 in 1887. Since the latter date only 17 species have been added to the list, viz., one in 1888, none in 1889, 1890, and 1891, three in 1892, two in 1893, none in 1894, three in 1895, four in 1896, two in 1897, one in 1898, none in 1899 and 1900, and one in 1901. The total, therefore, now stands at 217, and I am pleased to be able to add two species to-night, which will raise it to 219. I think it will be manifest to everyone that we cannot hope to go much beyond this. Consider for a moment. The official list of birds prepared by the British Ornithologists' Union contains the names of 384 species which for one reason or another may be called British birds—some of them, it must be admitted, on the very slender grounds of courtesy only. Mr. Howard Saunders, in the second (and latest) edition of his 'Manual of British Birds,' states that of this number 199 are said to have bred in the British Isles, and that in addition there are 45 species that regularly migrate to our Islands during the colder weather. This gives a total of 244 species that, I think it will be admitted, have a good claim to a place in the British list. The remaining 140 include 66 species that are more or less infrequent visitors, and 74 species that have been recorded as visiting our Islands less than six times. Turning now to the Herts list, I have previously mentioned that, including the two species now added, the total number recorded is 219.

Let me remark in passing that Mr. A. F. Crossman in 1898 compiled and published in the 'Transactions' the full list of recorded species, which at that time numbered 216. On reference to the official list, also compiled by Mr. Crossman, in vol. i of the recently-published 'Victoria History of Hertfordshire,' it will be seen that only 210 species are recorded, the following six being omitted:—The great reed-warbler (*Acrocephalus turdoides*), American red-winged starling (*Agelæus phœniceus*), Canada goose (*Bernicla canadensis*), Polish swan (*Cygnus immutabilis*), North American summer duck (*Aix sponsa*), Virginian colin (*Ortyx virginianus*). Doubtless Mr. Crossman was of opinion that the recorded visits of these species were open to question, or that in some cases they were only escaped, rather than truly wild species.

Now, referring back to our Hertfordshire list of 219 species, I find that of 39 of these species only one visit has been recorded, 18 species have only been recorded twice, 11 species three times, and 6 species four times. The total number of these species that have been recorded less than five times is therefore 74, the list of which is set out below.

BIRDS RECORDED ONCE ONLY.

Rock-Thrush.—*Monticola saxatilis* (1843).
Black Redstart.—*Ruticilla titys* (1893).
Dartford Warbler.—*Silvia undata* (1897) (R.).
Fire-crested Wren.—*Regulus ignicapillus* (1887).
Marsh-Warbler.—*Acrocephalus palustris* (1883).
Great Reed-Warbler.—*A. turdoides* (1865).
Water-Pipit.—*Anthus spipoletta* (1886).
Mealy Redpoll.—*Linota linaria* (1883).
Two-barred Crossbill.—*Loxia bifasciata* (1890).
Rustic Bunting.—*Emberiza rustica* (1882).
American Red-winged Starling.—*Agelæus phœniceus* (1879).
Rose-coloured Starling.—*Pastor roseus* (1902).
Chough.—*Pyrrhocorax graculus* (1884) (R.).
Wood-Lark.—*Alauda arborea* (1878) (R.).
Short-toed Lark.—*A. brachydactyla* (1886).
Roller.—*Coracias garrulus* (1852).
Scops Owl.—*Scops giu* (1902).
Montagu's Harrier.—*Circus cineraceus* (1875).
White-tailed Eagle.—*Haliaëtus albicilla* (1877) (R.).
Kite.—*Milvus ictinus* (1840) (R.).
Grey Lag-Goose.—*Anser cinereus* (1886) (R.).
White-fronted Goose.—*A. albifrons.*
Canada Goose.—*Bernicla canadensis* (1893).
North American Summer Duck.—*Aix sponsa* (1891).
Red-crested Pochard.—*Fuligula rufina* (1887).
Baer's Pochard.—*Nyroca Baeri* (1901).
Long-tailed Duck.—*Harelda glacialis* (1892).
Red-breasted Merganser.—*Mergus serrator* (1840–50).
Virginian Colin.—*Ortyx virginianus* (1882).
Little Crake.—*Porzana parva* (1887).
Baillon's Crake.—*P. bailloni* (1891).
Little Stint.—*Tringa minuta* (1885).
Temminck's Stint.—*T. temmincki* (1887).
Wood-Sandpiper.—*Totanus glareola* (1886).
Bar-tailed Godwit.—*Limosa lapponica* (1880).
Black-tailed Godwit.—*L. belgica* (1886).
Sandwich Tern.—*Sterna cantiaca* (1886).
Arctic Tern.—*S. macrura* (1886).
Red-necked Grebe.—*Podicipes griseigena.*

BIRDS RECORDED TWICE.

Woodchat.—*Lanius pomeranus* (1873 and 1885).
Hoopoe.—*Upupa epops* (1882 and 1888).

Gannet.—*Sula bassana* (1884) (R.).
Little Bittern.—*Ardetta minuta* (1884).
Glossy Ibis.—*Plegadis falcinellus* (1881).
Bean-Goose.—*Anser segetum* (1881).
Whooper Swan.—*Cygnus musicus* (1886).
Garganey.—*Querquedula circia* (1884).
Scaup.—*Fuligula marila* (1880).
Common Scoter.—*Œdemia nigra* (1881).
Velvet Scoter.—*Œ. fusca.*
Great Bustard.—*Otis tarda.*
Grey Plover.—*Squatarola helvetica* (1885 and 1887).
Redshank.—*Totanus calidris* (1885) (R.).
Whimbrel.—*Numenius phœopus* (1881) (R.).
Arctic Skua.—*Stercorarius crepidatus* (1881).
Guillemot.—*Uria troile* (1882).
Storm Petrel.—*Procellaria pelagica* (1881).

Birds recorded three times.

Dipper.—*Cinclus aquaticus* (R.).
Bearded Tit.—*Panurus biarmicus* (R.).
Golden Oriole.—*Oriolus galbula.*
Twite.—*Linota flavirostris.*
Little Owl.—*Athene noctua.*
Honey-Buzzard.—*Pernis apivorus.*
Polish Swan.—*Cygnus immutabilis.*
Pintail.—*Dafila acuta.*
Oyster-Catcher.—*Hæmatopus ostralegus* (R.).
Great Snipe.—*Gallinago major.*
Slavonian Grebe.—*Podicipes auritus.*

Birds recorded four times.

Merlin.—*Falco æsalon* (R.).
Sheldrake.—*Tadorna cornuta* (R.).
Goosander.—*Mergus merganser.*
Smew.—*M. albellus.*
Grey Phalarope.—*Phalaropus fulicarius.*
Kittiwake.—*Larus tridactyla.*

Of these 74 species, at least 14 (marked R.) must be included in the list of birds resident in the British Islands during the whole year—mostly, it is true, birds that haunt our coastlines, moorlands, and hilly or mountainous districts, and which therefore we only expect to hear of in Hertfordshire by means of some of those extraordinary accidents unavoidable by birds at their period of migration, or under the stress of storm or hard weather. I do not intend to trouble you with any notice of these, but I have selected two from the list of resident British birds that have only *once* been recorded in Hertfordshire to which I should like specially to direct your attention, as it seems reasonably certain that an observer primed with the information as to where to look and what to look for,

would with patience and perseverance be fairly certain to succeed in establishing further records of their presence. The two species to which I refer are the Dartford warbler and the wood-lark.

Of the first-named—the Dartford warbler or furze-wren (*Silvia undata*)—the only Hertfordshire record we have is given as follows in Mr. Crossman's list:—"A pair were seen by Mr. C. Worte on 1st May, 1897, on Common Wood Common, near Chipperfield, and were apparently nesting there. This is the only recorded occurrence of this bird in Hertfordshire, although many parts of the county abound in places suitable for it."

As its trivial names connote, it is a wren-like bird (and therefore small), a warbler, and one that finds its favourite haunts among the thick furze bushes which cover so many of our commons. Surely some of our widely-extending Hertfordshire commons offer it the very habitat which it loves, and as Mr. Howard Saunders states that it is more generally distributed in England than was for a long time supposed, that it is most abundant in the South of England, having bred in every county from Cornwall to Kent inclusive, and perhaps also in some of the Midland counties, and that it has of late years been extending its range both westward and northward, I think we have every reason to believe that careful observation by some of the members of our Society who reside near the furze-covered commons of the county would establish its undoubted title to a place in the list of Hertfordshire breeding-species.

Let any observer note, however, that, as Mr. Saunders states, "it is a skulking little bird, especially in dull rainy weather; and a patch of gorse holding two or three pairs may be easily passed over, even by a careful observer, as untenanted." Mr. W. H. Hudson states that it is "so elusive, that it is hard to find, and harder still to observe narrowly. Its somewhat singular appearance among the warblers—its small size, short, rounded wings, great length of tail, and very dark colour—its peculiar song, and excessively lively and restless habits, have all contributed to make it a fascinating subject to British Ornithologists."

Of the other resident to which I referred—the wood-lark (*Alauda arborea*)—Mr. Howard Saunders says: "Although nowhere plentiful, it is most frequent in some of the southern counties; it occurs on the Chiltern Hills, and is also fairly distributed along the dry, wooded, and rising ground on both sides of the valley of the Thames, as well as over the line of the chalk formation which runs from Bucks to West Norfolk and Suffolk."

Surely this is equivalent to almost telling us outright that the bird is a Hertfordshire bird, and yet, as I have pointed out, only one record of its presence has been made. This is given as follows in Mr. Crossman's list referred to above:—"The only record which I can find of this bird in Hertfordshire is a statement that in 1878 and 1879, during the month of March, this species was observed in a field close to Symond's Hyde Wood, in the parish of Sandridge, by Mr. A. F. Griffith, who had no doubt that it bred there."

The explanation is probably to be found in the general similarity of the bird to the skylark. To quote again from Mr. Hudson: "In appearance the woodlark is a lesser skylark, with a shorter tail in proportion to the body, and no apparent difference in colour, except that the spots on the breast and the pale streak over the eye are more conspicuous. It ranks with the six or eight finest British songsters, but it is the least known of all, being very generally mistaken for the skylark. The mistake is easily made, the song having the same character, and being a continuous stream of song, delivered in the same manner. He differs, however, from the skylark in his manner of rising; that bird goes up and up, not vertically, but inclining now to this side, now to that, with intervals of suspension: the woodlark ascends in circles, and finally does not attain to so great a height. He also sings from his perch on a tree, and rises from the tree to sing aloft, in this point resembling the tree-pipit" Mr. Saunders adds: "The woodlark may always be distinguished from the skylark by its smaller size, more pronounced crest, much shorter tail, more slender bill, and by the very broad buffish white stripes which run backward over each eye to the nape, where they join and show up the dark ear-coverts."

It is, of course, a much easier matter to trace out these differences in appearance when the birds lie on the dissecting-table before you, than when they are out in their native wilds and a passing glimpse may be the only chance of identification permitted to the observer. I trust, however, that the notes here given may enable some of our members in the north of the county to certify the resident character of this species. We ought not to allow ourselves to do such injustice to one of our resident species, and one moreover that is included amongst our finest songsters, as to let both his presence and his song be placed to the credit of one of his near relations, however estimable a fellow that near relation may be.

I have now given what I hope is a very fair summary of the work that has been done in compiling the records of our county ornithology. I have also pointed out one or two respects in which, in my opinion, careful and intelligently-directed observation may improve this record. Naturally enough, the question arises in everyone's mind—Is not the subject of birds practically worked out? Is it possible to do more? Can we hope to add any more to the list of species already seen? If not, what more can be done?

If the pursuit of ornithology led only to the compilation of a list of species, I admit that the subject is practically worked out so far as Hertfordshire is concerned. But does it? Surely, when we have succeeded in identifying and *naming* a bird, and placing that name on a list, we have done only the very least that can be done. We want to know, if possible, its history, and as Mr. Seebohm has well said: "The real history of a bird is its life-history. The deepest interest attaches to everything that reveals the little *mind*, however feebly it may be developed, which lies behind the feathers."

And this life-history is essentially one which can only be written from the sum-total of the facts garnered after the most careful, patient, and intelligent observation of the bird in all the varied aspects of its life and activity. Furthermore, life and the conditions of life are not constant, unalterable, and unaltering phenomena. On the contrary, they are, as we all know, in a state of perpetual flux and flow, and the birds, like all other organisms, are continually attempting to respond to modifications which are thus brought about in themselves and their surroundings. It is therefore not too much to say that facts once established by observation about a species do not hold good for all time. They must be modified by new facts discovered under the conditions I have all too briefly mentioned. There is no such thing as finality in Nature's operations or in the laws by which they are regulated. Our ornithology—let me say our county ornithology—is therefore not worked out, and by the very nature of the case never can be. I hope, therefore, that our local observers will not "give up the quest" as ended, but will repeat and renew their observations, and communicate the same for the information and the interest of their fellow-members of the Society.

V.

NOTES ON BIRDS OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1902.

By William Bickerton.

Read at Watford, 24th February, 1903.

In accordance with the usual practice I will commence my notes on the birds observed in 1902 with a few considerations in connection with the two species which, as I have mentioned in the previous paper, are new to our county list.

1. The Rose-coloured Starling (*Pastor roseus*). — Mr. A. E. Gibbs informs me that a specimen of this bird has just been added to the County Museum at St. Albans. It is said to have been shot at Bovingdon some years ago. A gentleman noticed the bird along with many others set up in a case in a local inn, and on enquiry was informed that all the specimens had been shot in the locality by the former landlord. The gentleman referred to purchased the specimen in question and handed it over to the Museum.

The record certainly is not as convincing as one could wish, but I think the evidence in its favour is at least as good as that which has sufficed to carry many other very rare visiting species into the official list.

The winter home of this bird seems to be in India and Turkestan, but in Summer it seems to be an irregular migrant to Asia Minor and the central and southern parts of Europe, occasional stragglers travelling so far as Norway, Sweden, Denmark, and the British Isles. Although specimens have been taken in Wales, Devon, and Cornwall, it occurs most frequently in the eastern counties. The adult male has a fine crest, which, with the head, neck, and throat, is of a glossy violet-black; its wings and tail are a metallic greenish black, while its back, shoulders, breast, and under parts are rose-pink. From this latter circumstance it has received its trivial name.

2. The Scops-Owl (*Scops giu*).—This bird has, I am informed, nested during the past Summer in Moor Park, Rickmansworth. It is the smallest owl which occurs in the British Isles, where it appears as a summer visitor, and examples have been previously obtained in Essex, Middlesex, and Bucks, though not in Herts. Three specimens were shot a few years ago in the valley of the Colne between Harefield and Heronsgate, in each case just beyond the county border. The winter home of this tiny owl—it is only about $7\frac{1}{2}$ inches in length — is in Abyssinia and Senaar. In summer it migrates to the temperate and warm parts of Europe, and is especially abundant in the countries of the Mediterranean area. Mr. Howard Saunders states that it is partial to cork and olive woods as well as to groves of trees on the banks of the rivers; that its note may be frequently heard in the gardens of large cities such as Seville and Florence; that it is particularly nocturnal in

habit; and that it feeds on beetles, grasshoppers, large moths, and other insects; perhaps also on small birds and mice, but is chiefly insectivorous. It has the ear-tufts so characteristic of some other members of its family. It is gratifying to be able to record its presence in Hertfordshire, not only as a visiting species, but also as a breeding species, and one can only hope that it received such protection as will encourage both parents and young to return to their former haunts.

In addition to the above species new to the county I have to bring to your notice three interesting records which are not entirely new.

1. The Little Owl (*Athene noctua*).—I am able to exhibit a specimen of this bird, which was trapped in the vicinity of Watford in December, 1901. This species has only twice been previously recorded for the county.

The bird is a generally-distributed resident in the south of Europe, especially in the Mediterranean area. It is not much given to migration, but specimens occasionally visit this country. Several British naturalists—among them the late Lord Lilford—have made more or less successful attempts to introduce this species. Mr. M. R. Pryor informs me that these birds have bred in the north of the county during the past four years, a very gratifying piece of information.

2. Peregrine Falcon (*Falco peregrinus*). — The peregrine, according to Mr. Crossman's list, has been previously recorded in the county at least 15 times, but on only one of these occasions were two birds obtained. It is therefore quite an unusual occurrence for two of these noble hawks to be obtained at the same time and in the same place, and we must account ourselves particularly privileged in being able to examine the two—I do not say pair, for I think they are both females—I am able to exhibit to-night. These birds were taken in the vicinity of Watford in December, 1901. One of them was reported to me as the goshawk (*Astur palumbarius*), a specimen of which has never yet been recorded for Hertfordshire. It was on the strength of this information that a statement was made as to my endeavouring to exhibit a goshawk. On thoroughly looking into the matter, however, there is no doubt, as members will see for themselves, that the birds are both peregrines—hawks which are known locally in many parts of the country as "goshawks," but of course are not so. The captor of this so-called "goshawk" informed me that with wings expanded the bird measured 42 inches from tip to tip, and was, roughly speaking, "about as heavy as a pheasant." It was seen to swoop at and capture a partridge. It has been mounted by a local bird-stuffer.

This fine bird is a resident in Britain, and fortunately is still fairly common in many parts, especially in Scotland and Ireland. It is mostly to be found on our rugged rock-bound coastlines, for only in such places, as a rule, is it allowed to breed without disturbance. Mr. H. Saunders states that in Connemara one nesting-site, known to have been frequented in 1684, is still utilised.

This magnificent "hunting hawk," as it is called in some districts, takes toll on "ducks, waders, sea-fowl (especially puffins), pigeons, grouse, partridges, lapwings, hooded crows, rooks, choughs, magpies, jays, and even kestrels, while it sometimes sweeps rabbits off the side of a cliff." From this comprehensive bill of fare our smaller birds seem mercifully excluded.

I feel that I cannot help quoting the subjoined passage from the pen of Mr. W. H. Hudson. He says: "This famed bird is of a handsome appearance, not swallow-like as is the kite, nor so massive as the eagle; but nature in fashioning it has observed the golden mean, and the result is a being so well-balanced in all its parts and so admirably adapted for speed, strength, and endurance, that to many minds it has seemed the most perfect among winged creatures. When standing perched on a crag, erect and motionless, as its custom is, its smooth and compact figure looks as if carved out of a stone or marble of a beautiful soft grey tint. The wings are sharp-pointed, and the flight is exceedingly rapid.

"It has always seemed to me that the peregrine, alone among hawks, possessed a courage commensurate with its strength; and, in hunting, an infallible judgment. However swift of wing its quarry might be, it was almost invariably overtaken and struck to the earth; and the bird thus vanquished was in many cases the equal, and sometimes even the superior, in weight to the falcon. All other hawks make frequent mistakes, and often fail in their efforts; they chase birds they cannot overtake, and attack others that are too strong for them; and occasionally their courage fails, and they pass by the healthy and strong to attack the wounded or weak that are incapable of making an effort."

Finally, let me remark that the average length of the female peregrine is given as 18 inches, the male 3 inches less. The specimens exhibited must therefore be considered rather fine ones, as they measure respectively 22¾ inches and 22 inches.

Since the above paragraph was written I have been informed by Mr. E. P. Thompson, of Elstree, that a peregrine was seen at the Reservoir in October last, and that the bird is still haunting the neighbourhood.

3. Red-breasted Merganser (*Mergus serrator*).—The Hon. Walter Rothschild informs me that a pair of these birds were shot in November, 1901, at Tring. This species has been recorded only once previously in the county (Munden, 1840–50).

General Notes.

Ring-Ouzel (*Turdus torquatus*). — I am informed that this interesting bird has nested at Gorhambury, St. Albans, during the past year. This is the first occasion on which it has been recorded as breeding in the county. Specimens are frequently seen at the spring and autumn migrations.

Nightingale (*Daulias luscinia*).—It is gratifying to be able to record that this favourite, though, fortunately for itself, little-known bird (apart from its song) was one of the most numerous summer

visitors last year. I had the pleasure of finding a nest containing five eggs within a few yards of a well-frequented public footpath. The brood got safely off. At least one pair also haunted a by no means retired part of High Street, Watford, and the song could be heard nightly about the end of April.

Chiffchaff (*Phylloscopus rufus*).—I fear there can be no doubt that this little "harbinger of Spring" is sadly decreasing in numbers in the county. Several of my correspondents have noticed its increasing scarcity.

Blue Tit (*Parus cæruleus*).—So far as my own observation goes, this attractive little bird has been unusually numerous during the Autumn and Winter. Previously I should have said that this tit was the least numerous of the four common species, great tit, marsh-tit, coal-tit, and blue tit, but during the period named the number of blue tits I have seen has exceeded all the others put together.

Tree-Creeper (*Certhia familiaris*).—This bird, on the other hand, has been unaccountably scarce in the Watford district. I have not seen a specimen in Cassiobury Park for months. Previously I never failed to see at least one on every ramble, and occasionally I have seen three or four in the course of a single walk.

Meadow-Pipit (*Anthus pratensis*).—In Mr. Crossman's list it is stated that a few pairs remain to nest in suitable localities chiefly on the northern boundary of the county. It may therefore be worth recording that during the past Summer I found within a short distance of Watford a nest containing four eggs.

House-Martin (*Chelidon urbica*).—Mr. Gibbs informs me that a St. Albans gentleman observed two of these birds clinging to one of the windows of St. Peter's Church during the first week in December. Mr. H. Lewis also reports that two were seen near the L. and N.W. Railway Station in the same town on November 8th. Surely the first of these records would have intensified that haunting mystery as to the wintering of the Hirundines which proved such a source of perplexity to the great naturalist of Selborne!

I think there can be no doubt as to the increasing scarcity both of swallows and house-martins during recent years.

Goldfinch (*Carduelis elegans*).—In November I was informed by a workman at one of our local watercress-beds that he had seen a fairly large flock of these exquisite little birds, and had counted over 40. This is good news indeed. On the other hand, the Hon. A. Holland-Hibbert informs me that he has not seen a single specimen in his district for the last fifteen years. Mr. E. P. Thompson reports having seen five together at Elstree, and states that apart from this "very few, if any, have been seen for three or four years." Mr. M. Vaughan, of Haileybury, reports that "goldfinches are fast becoming extinct."

The reason usually given in explanation of the decrease in the number of goldfinches is the decrease in thistles and thistle-seeds owing to the improvement in methods of agriculture, and the

consequent failure of the bird to obtain the necessary supplies of its favourite food. Personally I believe the main reason to be the persecution of birdcatchers. Thistles grow mostly on waste and common lands, goldfinches therefore mostly frequent such lands for the thistledown. Birdcatchers, knowing this, and having the free run of such lands, go there after the goldfinches, in spite of the fact that this bird is protected all the year round (and, unfortunately, is the only one so protected) by the Herts County Council under the Wild Birds' Protection Act.

With regard to the food-supply of the goldfinch, it may be interesting to state that on two occasions during the past three months I have seen this bird in company with redpolls and siskins feeding in the alder-trees by the side of the stream in Cassiobury Park.

Brambling (*Fringilla montifringilla*).—I have not seen or heard of a single brambling during the whole Winter. No doubt the mildness of the season has enabled these birds to find food without travelling so far south.

Kingfisher (*Alcedo ispida*).—This brilliant bird is, I am pleased to record, increasing in numbers in the Watford district. On more than one occasion during the past year I have seen five or six specimens on a single ramble. In May I was fortunate enough to observe one of its nesting-haunts, not many yards from one of our main roads.

On one of the bleak, wintry days of February (1902) I noticed what was to me a new habit of the kingfisher, that, namely, of hovering. The river was partly frozen over, and one of the birds I disturbed, after flying a little distance away, suddenly poised himself in mid-air for a short time over a particular spot on the ice. After an interval he moved further along and repeated the same performance, his wings beating rapidly during the whole period.

Cuckoo (*Cuculus canorus*).—It appears that the cuckoo has this year remained beyond his usual time, as Mr. H. Lewis reports that his call-note was heard near St. Albans so late as July 14th.

Our President, Mr. Lewis Evans, reports that a cuckoo's egg was deposited in a hedge-sparrow's nest in a box-bush near a path in his garden, and that the owners of the nest promptly deserted it, leaving two of their own eggs along with the intruding one. Mr. E. P. Thompson (Elstree) reports the finding of the cuckoo's egg in the nests of the yellow-hammer and robin.

Heron (*Ardea cinerea*).—Last year I was much gratified at being able to report that during the Summer of 1901 a pair of these birds had nested on an estate near Watford, and that owing to the careful protection afforded them by the owner they had successfully hatched their brood. I have now to record the melancholy fact that practically the whole lot has been slaughtered by the keeper of a neighbouring estate—a sacrifice to the inhabitants of his trout-stream.

Quail (*Coturnix communis*).—Mr. M. R. Pryor reports that this bird, which up to about fifteen years ago used to nest in the

neighbourhood of Stevenage, has now become practically extinct there. Mr. Pryor further reports that the coot (*Fulica atra*) and the dabchick (*Podicipes fluviatilis*) have ceased to nest and are seldom seen in the district.

The following birds are reported to have been *scarcer* during recent years:—Chiffchaff, linnet, swallow, house-martin, kestrel, landrail, magpie, wryneck, hawfinch, sparrow-hawk, red-backed shrike, nightjar, grasshopper-warbler, jay, quail, snipe, woodcock, golden plover, fieldfare, and redwing; while the following are reported as being *on the increase*:—Missel-thrush, blackbird, song-thrush, goldfinch (slightly), robin, sparrow, starling, kingfisher, green woodpecker, wood-pigeon, and marsh-tit.

Of curious nesting-places I have only received three records.

Robin.—A nest was built in a creel or basket hanging in a shed in the garden. Access could only be obtained through a narrow aperture or slit at the top. (*Mr. H. Lewis.*)

Red-legged Partridge.—A nest was built on the ivy-covered top of a garden wall 5 feet high, and about 3 yards from an entrance door and 6 yards from the drawing-room window. Ten eggs were laid. (*Mr. Lewis Evans.*)

Blue Tit.—A blue tit generally nests every year in a hole in an iron gatepost, close to which many boys [at Haileybury] pass daily. (*Mr. Vaughan.*)

The usual list of summer visitors with dates of arrival is given herewith.

Species.	Locality.	Date.	Observer.
Stonechat (*Pratincola rubicola*)	Berkhamsted	April 3	H. Lewis.
Redstart (*Ruticilla phœnicurus*)	Watford	May 11	W. Bickerton.
Nightingale (*Daulias luscinia*)	Hitchin	April 12	A. W. Dawson.
	Croxley Green	,, 13	W. Bickerton.
	Hatfield	,, 13	T. Brown.
	St. Albans	,, 14	H. Lewis.
	Bushey Heath	,, 14	P. J. Barraud.
	Berkhamsted	,, 16	Mrs. E. Mawley.
	Watford	,, 16	Mrs. Bishop.
	Harpenden	,, 17	J. J. Willis.
	Elstree	,, 18	E. P. Thompson.
	Preston	,, 19	R. de V. Pryor.
	Broxbourne	,, 20	Rev. H. P. Waller.
	Sawbridgeworth	,, 20	J. J. Rivers.
Greater Whitethroat (*Silvia cinerea*)	Bushey Heath	,, 18	P. J. Barraud.
	Elstree	,, 19	E. P. Thompson.
Lesser Whitethroat (*Silvia curruca*)	Bushey Heath	,, 20	P. J. Barraud.
Blackcap (*Silvia atricapilla*)	Bushey Heath	,, 13	P. J. Barraud.
	Newberries, Radlett	,, 14	Mrs. Verity.
	St. Albans	,, 21	H. Lewis.
Garden-Warbler (*Silvia undata*)	Bushey Heath	,, 22	P. J. Barraud.
Chiffchaff (*Phylloscopus rufus*)	Berkhamsted	Mar. 28	H. Lewis.
	Newberries, Radlett	,, 31	Mrs. Verity.
	Bushey Heath	April 1	P. J. Barraud.

Species.	Locality.	Date.	Observer.
Willow-Wren (*Phylloscopus trochilus*)	Bushey Heath	April 10	P. J. Barraud.
	St. Albans	,, 14	H. Lewis.
	Watford	,, 17	W. Bickerton.
	Newberries, Radlett	,, 18	Mrs. Verity.
Wood-Wren (*Phylloscopus sibilatrix*)	Bushey Heath	,, 30	P. J. Barraud.
Sedge-Warbler (*Acrocephalus phragmitis*)	Tolpits, Watford	,, 24	W. Bickerton.
Tree-Pipit (*Anthus trivialis*)	Bushey Heath	,, 12	P. J Barraud.
	Croxley Green	,, 13	W. Bickerton.
Red-backed Shrike (*Lanius collurio*)	St. Albans	May 25	A. E. Gibbs.
Spotted Flycatcher (*Muscicapa grisola*)	Chandler's Cross	April 27	W. Bickerton.
	Berkhamsted	May 17	Mrs. E. Mawley.
	Broxbourne	,, 26	Rev. H. P. Waller.
	Hatfield	,, 26	T. Brown.
Swallow (*Hirundo rustica*)	Sawbridgeworth	April 7	H. S. Rivers.
	Broxbourne	,, 8	Rev. H. P. Waller.
	Harpenden	,, 9	J. J. Willis.
	St. Albans	,, 10	H. Lewis.
	Bushey Heath	,, 13	P. J. Barraud.
	Elstree	,, 13	E. P. Thompson.
	Hatfield	,, 13	T. Brown.
	Berkhamsted	,, 14	Mrs. E. Mawley.
	Solesbridge	,, 17	W. Bickerton.
	Preston	,, 19	R. de V. Pryor.
	Watford	,, 19	Mrs. Hopkinson.
(Last seen)	Berkhamsted	Oct. 13	Mrs. E. Mawley.
	Watford	,, 19	Mrs. Hopkinson.
	Sawbridgeworth	,, 23	H. S. Rivers.
	Broxbourne	,, 30	Rev. H. P. Waller.
House-Martin (*Chelidon urbica*)	Watford	April 16	W. Bickerton.
	St. Albans	,, 21	H. Lewis.
	Bushey Heath	,, 25	P. J. Barraud.
(Last seen)	St. Albans	Nov. 8	T. F. Woodman.
Sand-Martin (*Cotile riparia*)	St. Albans	April 21	H. Lewis.
Swift (*Cypselus apus*)	St. Albans	May 6	H. Lewis.
	Oxhey, Watford	,, 10	W. Bickerton.
	Bushey Heath	,, 19	P. J. Barraud.
(Last seen)	Bushey Heath	Aug. 15	P. J. Barraud.
Nightjar (*Caprimulgus europæus*)	St. Albans	May 9	A. Dickenson.
Wryneck (*Iÿnx torquilla*)	Elstree	April 11	E. P. Thompson.
	St. Albans	,, 13	H. Lewis.
	Bushey Heath	,, 23	P. J. Barraud.
Cuckoo (*Cuculus canorus*)	Berkhamsted	,, 13	Mrs. E. Mawley.
	Bushey Heath	,, 13	P. J. Barraud.
	Elstree	,, 13	E. P. Thompson.
	Watford	,, 14	Mrs. Bishop.
	St. Albans	,, 14	H. Lewis.
	Hatfield	,, 15	T. Brown.
	Newberries, Radlett	,, 16	Mrs. Verity.
	Broxbourne	,, 16	Rev. H. P. Waller.
	Sawbridgeworth	,, 16	H. S. Rivers.
	Harpenden	,, 17	J. J. Willis.
	Watford	,, 19	W. Bickerton.
Turtle-Dove (*Turtur communis*)	St. Albans	,, 30	A. Dickenson.

I am indebted to Mr. P. J. Barraud, of Bushey Heath, for the following interesting table:—

SUMMER MIGRANTS.

Name.	Date of arrival at Bushey Heath, 1902.	Average date of arrival during previous 8 years.
Nightingale	April 14	April 20
Greater Whitethroat	,, 18	,, 24
Lesser Whitethroat	,, 20	,, 28
Blackcap Warbler	,, 13	,, 15
Garden-Warbler	,, 22	,, 27
Chiffchaff	,, 1	Mar. 29
Willow-Wren	,, 10	April 7
Tree-Pipit	,, 12	,, 12
Swallow	,, 13	,, 16
House-Martin	,, 25	,, 30
Swift	May 19	May 6
Wryneck	April 23	April 13
Cuckoo	,, 13	,, 17

From this it will be seen that eight species out of the thirteen arrived earlier, and four later, than the average date, and that the remaining species arrived exactly on the mean date.

In conclusion, I desire to tender to all my correspondents and local recorders my sincere thanks for their kindness in sending their notes to me, and to express the hope that they will favour me in the same direction year by year.

VI.

REPORT ON PHENOLOGICAL PHENOMENA OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1902.

By Edward Mawley, Vice-Pres. R. Met. Soc., F.R.H.S.

Read at Watford, 21st April, 1903.

It is a matter for regret that the neighbourhood of Buntingford, in the north-east of the county, is altogether unrepresented in this and previous reports. With this exception the distribution of the observing stations is as satisfactory as could be wished. The only changes during the past year have been the removal of the observer at Oxhey Lane, Watford, to Harefield, just outside the southern borders of the county, and the introduction of a new observer at St. Albans. Unfortunately for that part of the present report which has reference to the flowering of plants, only two observations were received during the year from Broxbourne and the same number from St. Albans, and only three observations from Hitchin. It is much to be hoped that another year the returns sent in from these stations may be more complete. The observations from Hitchin have hitherto been unusually good.

The following table gives the list of observers, the districts they represent, and the approximate height of the stations above sea-level. The sequence is from south to north.

Station.	Height above Sea-level.	Observer.
Harefield (The Scrubbs)	340 feet.	G. E. Eland.
Watford (The Platts)	240 ,,	Mrs. G. E. Bishop.
Watford (Weetwood)	270 ,,	Mrs. J. Hopkinson.
Chesham (Cannon Mill Cottage)	300 ,,	Miss G. Keating.
Broxbourne	120 ,,	Rev. H. P. Waller.
St. Albans (Worley Road)	300 ,,	H. Lewis.
St. Albans (Kitchener's Meads)	270 ,,	A. E. Gibbs, F.L.S.
Berkhamsted (Rosebank)	400 ,,	Mrs. E. Mawley.
Hatfield (Symonds Hyde)	300 ,,	T. Brown.
Hertford	140 ,,	W. Graveson.
Sawbridgeworth	240 ,,	H. S. Rivers.
Harpenden (Hecla Villa)	370 ,,	J. J. Willis.
Hitchin	230 ,,	A. W. Dawson, M.A.
Odsey, Ashwell	260 ,,	H. G. Fordham.

The Winter of 1901–2.

Taken as a whole, this was a rather mild, rather dry, and somewhat gloomy Winter. With the exception of two weeks in December and three weeks in February the weather continued very mild. Of the two cold periods that in February was not only the most prolonged, but the most severe—on the coldest night the exposed thermometer at Berkhamsted registered 25 degrees of frost.

The distribution of the rainfall was equally variable. For instance, the last three weeks in December, and the closing week in February, were extremely wet, while no rain worth mentioning fell during the intervening period of over seven weeks. The record of sunshine at Berkhamsted fell short of the average by about five minutes a day.

All fears that the young wheat would become dangerously forward owing to the mild weather in January were set at rest by the timely arrival of the long February frost. Although there was no snow to protect any of the farm crops, little, if any, damage appears to have been done by this frost—an exceptionally prolonged one for so late in the season. This was no doubt in a great measure owing to the unusually dry state of the soil and subsoil. Indeed, throughout the whole of the time the frost lasted, no measurable quantity of rain-water came through either of my percolation-gauges, which are a yard square and contain $2\frac{1}{2}$ feet of soil. The pastures were well furnished with herbage during December and January, which was a great advantage to the farmers, as there remained but a small supply of winter forage for the sheep and cattle, owing to the failure of the hay and turnip crops in the previous year. After December all seasonable tillage operations were carried out with but few interruptions, and were consequently at the end of the season as forward as could be wished.

This was on the whole a favourable Winter for all garden produce. The mild weather in the early part of it favoured the rather scanty supply of green vegetables left by the previous dry Summer and Autumn; while the February frost gave a wholesome check to the pushing buds of the fruit-trees, and to vegetation generally.

The winter aconite came into flower at Berkhamsted on the 14th of January, or a week earlier than its average date in the previous thirteen years, and earlier than in any year since 1898. On the 20th the same plant was noted as first in flower at St. Albans.

Taking the county as a whole, the first fertile flowers appeared on the hazel three days later than their average date in the previous twenty-five years. The song-thrush was first heard after the beginning of the year eleven days in advance of its mean date; while the honey-bee was first seen to visit flowers one day behind its usual time.

The Spring.

The weather became colder as the season advanced, March being very warm, April of about average temperature, and May exceptionally cold—indeed, the coldest May of which I have at Berkhamsted any record. On one night in the middle of that month the thermometer exposed on the lawn indicated 9 degrees of frost, which is an unusually low reading for so late in the Spring. The fall of rain was below the mean quantity, but only in April was the deficiency very marked. The sun shone on an average for about half an hour a day less than is usual during the quarter.

The sowing of all the spring crops was carried out under exceptionally favourable conditions, owing to the disintegrating effect upon the soil of the long frost in February, the moistening influence of the wet week which followed, and the almost continuously dry weather in March and April, by which that wet week was succeeded. Even in May, although some rain fell almost every day, the amounts were, as a rule, small, and by that time the ground had become so dry that it quickly absorbed any superfluous moisture. Consequently all the spring corn and other seeds were got in in good time, and when the soil was in as friable and perfect a condition as it well could be to receive them. The grass, except during the cold period in May, continued to make slow but steady progress, and with a change to more genial weather in the last week in May a more rapid advance was made. At the end of the season our farm crops have seldom presented so early in the year a more promising appearance.

The garden seeds were also sown under equally propitious circumstances, and consequently germinated quickly, and with unusual regularity. The one drawback of this Spring was the continued cold weather, and the frequent frosty nights during the first fortnight in May, which did much damage to the abundant fruit-blossom, and blackened the potatoes and other tender plants, more particularly in low-lying localities.

At Watford the blackthorn blossom was noted as unusually abundant. At Harefield the first swift was seen on the 18th of May, and at Odsey on the day following.

All the spring flowering plants on the list blossomed later than usual. The coltsfoot was fourteen days late, the wood-anemone twelve days late, the blackthorn four days late, the garlic hedge-mustard three days late, the horse-chestnut one day late, the hawthorn eight days late, and the white ox-eye twelve days late.

As had been the case in the three previous years, the spring migrants arrived somewhat behind their average dates. The swallow was one day late, the cuckoo two days late, the nightingale one day late, while the flycatcher (taking its average date for the nine years for which observations are available) was eleven days late.

The wasp made its appearance ten days late, the small white butterfly one day late, and the orange-tip butterfly seventeen days late. Only two observers sent in dates for the meadow-brown butterfly—both extremely late ones.

The Summer.

Each of the three summer months was more or less cold, and taking the three together the mean temperature was lower than in any Summer for fourteen years. As affecting vegetation the most noteworthy feature was the fortnight of very cold weather in the middle of June—on one night at Berkhamsted the exposed thermometer registered 2 degrees of frost. The total rainfall was slightly below the average; for although June and August were both wet months, the fall of rain in July, on the other hand,

TABLE I.—DATES OF FLOWERING OF PLANTS OBSERVED IN 1902, WITH THE MEAN DATE FOR 1876–1901.

SPECIES.	HARE-FIELD.	WATFORD.		CHES-HAM.	BROX-BOURNE.	BERK-HAMSTED.	HAT-FIELD.	HERT-FORD.	SAW-BRIDGE-WORTH.	HAR-PENDEN.	HITCHIN.	ODSEY (Ashwell)	MEAN.
		THE PLATTS.	WEET-WOOD.										
Hazel (*Corylus avellana*)	Mar. 1	Feb. 27	Feb. 7	Jan. 8	Jan. 20	Mar. 1	Jan. 23	Jan. 12	.....	Feb. 3	Jan. 25	Jan. 10	Jan. 29
Coltsfoot (*Tussilago farfara*)	Mar. 9	Mar. 31	.....	.....	.....	Feb. 26	Mar. 21	Mar. 6	Mar. 13	Mar. 13	Mar. 9	.....	Feb. 28
Wood-Anemone (*Anemone nemorosa*)	Apl. 19	.....	Apl. 1	.....	.....	Apl. 5	Apl. 3	Mar. 16	.....	Apl. 12	.....	.....	Mar. 23
Blackthorn (*Prunus spinosa*)	Apl. 18	Mar. 27	Apl. 11	Apl. 8	.....	Apl. 15	Apl. 13	Mar. 23	Apl. 7	Apl. 13	.....	Apl. 12	Apl. 4
Garlic Hedge-Mustard (*Alliaria officinalis*)	.....	.....	Apl. 16	Apl. 23	.....	Apl. 29	.....	Apl. 20	.....	Apl. 25	.....	.....	Apl. 20
Horse-Chestnut (*Æsculus hippocastanum*)	May 3	May 12	Apl. 30	May 9	.....	May 16	Apl. 30	May 9	May 20	May 12	.....	.....	May 9
Hawthorn (*Cratægus oxyacantha*)	May 11	May 21	May 23	May 24	.....	June 1	May 13	May 2	May 29	May 24	.....	.....	May 12
White Ox-Eye (*Leucanthemum vulgare*)	June 6	.....	June 2	May 28	.....	June 1	June 1	May 29	.....	.....	.....	.....	May 20
Dog-Rose (*Rosa canina*)	.....	.....	June 22	June 20	.....	June 14	June 15	June 22	.....	June 18	.....	June 21	June 5
Black Knapweed (*Centaurea nigra*)	.....	.....	July 11	.....	.....	July 8	July 13	July 6	.....	July 10	.....	.....	June 24
Harebell (*Campanula rotundifolia*)	.....	July 17	July 7	.....	.....	July 15	July 14	July 17	.....	July 5	.....	.....	July 5
Greater Bindweed (*Convolvulus sepium*)	July 24	.....	.....	July 8	.....	July 8	July 20	July 17	.....	July 18	.....	.....	July 9
Ivy (*Hedera helix*)	.....	Oct. 9	Oct. 4	.....	Sept. 28	Oct. 19	.....	Sept. 28	.....	.....	Oct. 4	Oct. 7	Sept. 27

At St. Albans (Kitchener's Meads) the Horse-Chestnut flowered on May 17th, and the Hawthorn on May 19th.

TABLE II.—EARLIEST DATES OF OBSERVATION OF BIRDS AND INSECTS IN 1902, WITH THE MEAN DATE FOR 1876–1901.

SPECIES.	HARE-FIELD.	WATFORD.		CHES-HAM.	BROX-BOURNE.	ST. ALBANS (Worley Road).	BERK-HAMSTED.	HAT-FIELD.	SAW-BRIDGE-WORTH.	HAR-PENDEN.	HITCHIN.	ODSEY (Ashwell)	MEAN.
		THE PLATTS.	WEET-WOOD.										
BIRDS.													
Song-Thrush (*Turdus musicus*)	.....	Jan. 1	.....	.....	Jan. 4	Jan. 3	Jan. 1	Jan. 8	Jan. 3	Jan. 18	Jan. 1	Jan. 13	Jan. 17
Swallow (*Hirundo rustica*)	Apl. 25	Apl. 23	Apl. 19	Apl. 12	Apl. 8	Apl. 10	Apl. 14	Apl. 13	Apl. 7	Apl. 9	.....	Apl. 5	Apl. 12
Cuckoo (*Cuculus canorus*)	Apl. 13	Apl. 14	Apl. 16	Apl. 15	Apl. 16	Apl. 14	Apl. 13	Apl. 15	Apl. 16	Apl. 17	.....	Apl. 21	Apl. 13
Nightingale (*Daulias luscinia*)	Apl. 15	Apl. 16	Apl. 20	Apl. 14	Apl. 20	Apl. 14	Apl. 16	Apl. 13	Apl. 20	Apl. 17	Apl. 12	Apl. 19	Apl. 15
Spotted Flycatcher (*Muscicapa grisola*)	.....	.....	.....	.....	May 26	.....	May 17	May 26	.....	.....	.....	May 27	May 13 (9 years)
Swallow (last seen) (*Hirundo rustica*)	Oct. 4	.....	Oct. 19	Oct. 12	Oct. 30	.....	Oct. 13	.....	Oct. 23	.....	.....	Oct. 29	Oct. 17 (11 years)
INSECTS.													
Honey-Bee (*Apis mellifica*)	.....	.....	Mar. 2	Jan. 6	Feb. 4	.....	Jan. 23	.....	Feb. 25	.....	Jan. 18	.....	Feb. 1
Wasp (*Vespa vulgaris*)	.....	Apl. 25	Apl. 19	May 18	Apl. 17	.....	Mar. 7	.....	Apl. 15	.....	.....	.....	Apl. 7
Small White Butterfly (*Pieris rapæ*)	Mar. 12	Mar. 27	Apl. 19	.....	Apl. 24	.....	Mar. 17	.....	Apl. 28	.....	.....	.....	Apl. 5
Orange-Tip Butterfly (*Anthocaris cardamines*)	.....	.....	May 26	May 14	.....	.....	June 1	.....	.....	.....	.....	.....	May 7
Meadow-Brown Butterfly (*Epinephile janira*)	.....	.....	.....	.....	.....	.....	July 30	.....	July 4	.....	.....	.....	May 20

proved extremely light. In all three months the record of sunshine at Berkhamsted was deficient, the deficiency for the whole season averaging nearly an hour a day. In August the sun shone on an average for only 4¼ hours a day.

Scarcely any progress was made by the corn and other farm crops until after the end of the cold and wet period in June, when a return to unusually warm weather took place. The effect upon the landscape of this change to more genial conditions, which set in at the end of the third week in June, was almost magical. The rapid growth was not only brought about by the warmer atmosphere both during the daytime and at night, but also by the rising temperature of the soil itself, which was moreover at that period in a singularly moist condition for the time of year. The crop most favoured by this spell of warm weather, which lasted about three weeks, was the hay-crop. The yield proved exceptionally heavy, and as very little rain fell during July it was harvested at little expense, and in excellent condition. The roots and pastures were also greatly benefited by the change, and the cereals advanced rapidly and were in every way improved. Had this type of weather persisted sufficiently long, the corn harvest would have been, after all, unusually early, instead of being one of the latest and most prolonged for many years. Unfortunately, at the end of the three warm weeks in question came a period of cold, dull, and rainy weather, which continued until the end of the season, so that the corn ripened slowly, and when cut was gathered in under the most trying conditions possible, owing to the frequent and heavy rains. The yield of all the corn-crops was good, but owing to the long period of wet weather in August much of it remained in shock in the fields, and a good deal of the grain became stained and sprouted. The roots and pastures were, on the other hand, as is usual under such conditions, benefited by the lower temperatures and frequent rainfall. There was also another crop which appeared to delight in the cool and moist weather, and that was the crop of weeds, which have seldom been so troublesome.

This Summer was not nearly so favourable to the horticulturist as to the farmer. In the first place the cold weather in June was so keenly felt that many plants did not completely recover from its chilling effects during the rest of the season. Then came a drought which may be said to have lasted from the middle of June until the end of July, so scanty was the rainfall during those seven weeks. In fact, previous to the 6th of August no rain-water at all had come through my bare soil percolation-gauge for five weeks. The wet, cold, and gloomy weather which followed, while favouring the growth of weeds, was very unfavourable to garden-produce generally, and more particularly to that in the flower-garden. The appearance and rapid spread of the potato disease in August was also another result of the low temperature and humid condition of the ground and atmosphere. On the other hand, for the first Summer for some years, the Hertfordshire lawns remained green throughout the whole season.

Mr. Willis reports from Harpenden that the first ear of wheat was out of its sheath on June 20th, which is eleven days later than its average date in the previous ten years, and later than in any of those years.

The plants on the list which flower during the summer months were all very late in coming into blossom. The dog-rose was fourteen days late, the black knapweed sixteen days late, the harebell eight days late, and the greater bindweed seven days late.

The Autumn.

Taken as a whole, this was a moderately warm Autumn, and in none of the three months composing it was the departure from the average in mean temperature in any way remarkable. In fact, in respect to temperature, the most noteworthy feature was an almost unbroken period of warm weather which lasted from the middle of October until the middle of November. The rainfall was very scanty—indeed, not much more than half the average quantity for the quarter. The record of sunshine at Berkhamsted was also small, falling short of its seasonable duration by about ten minutes a day.

The harvest was completed under very much more favourable conditions as regards weather than those which prevailed when it began, owing to the dry and warm weather in the early part of September. The damage done to the cereal crops by the frequent and heavy rains of August appears to have varied a good deal in different parts of the county, and even to some extent in the same district, but only here and there are the reports in any way favourable, except as regards the yield of grain and straw, which was almost everywhere unusually good. Notwithstanding the small rainfall, turnips, swedes, and mangolds continued to make good growth throughout the Autumn. There was also never any lack of grass in the pastures, which remained clothed with abundant herbage until the end of the season.

Seldom has there been an Autumn so favourable to so many garden plants as that of 1902. Owing to the heavy rainfall in August and the moderate rains which at times occurred afterwards, the ground was always sufficiently moist, while the continuous spell of warm weather during the four weeks ending November 16th enabled them to continue growing unchecked until unusually late in that month. The consequence was that while the winter supply of vegetables was greatly benefited in the kitchen-garden, roses, dahlias, Michaelmas daisies, and other autumn-blooming plants were equally favoured in the flower-garden.

Owing to their earlier publication I am for the first time enabled to give the estimated departures from the average in the yield of farm-produce in Hertfordshire from the official returns published by the Board of Agriculture. According to these returns the yield of wheat and barley was 9 per cent. in excess of their respective averages for the previous ten years, oats 8 per cent. in excess, beans 15 per cent. in excess, peas 10 per cent. in excess, turnips

26 per cent. in excess, mangolds 23 per cent. in excess, hay (from clover, etc.) 26 per cent. in excess, and hay (from permanent pastures) 23 per cent. in excess of the ten years' average. Indeed, the only deficient crop was that of potatoes, which is estimated at 25 per cent. in defect of its average yield.

The fruit-crops, according to the returns sent in to the 'Gardeners' Chronicle,' were, taking the county as a whole, very poor, the crops of apples, pears, plums, cherries, gooseberries, raspberries, and currants being all below the average. On the other hand, the yield of strawberries, although it varied a good deal in different places, was on the whole a fairly good one.

Mrs. Bishop, writing from The Platts, Watford, on October 1st, states that her apples were a poor crop, and most of them very small and blighted; indeed, the Blenheim oranges were absurdly small. On this point our valued Harpenden observer, Mr. Willis, writes: "There were many rainy days in 1902, but the rainfall was deficient. This lack of water was severely felt by all deep-rooting vegetation such as fruit-trees. These produced abundance of blossom, but the greater part, especially of plums and cherries, fell off. The apples even, although they were formed, could not be brought to maturity by the trees, and they accordingly prematurely fell or developed puny fruits." He adds: "There were good grain-crops, but the excessive rain of August considerably damaged the corn after it was cut, and much sprouted while standing in the shock."

In order to illustrate the character of the season I set up a large number of choice rose-blooms at the Berkhamsted Chrysanthemum Show, which was held on November 12th, and also flowering specimens of fifty-four different kinds of other plants—all gathered from the open ground in my garden. On the 18th of the same month I exhibited at the Royal Horticultural Society's Exhibition in London an equally good exhibit of cut roses. On November 14th "a lovely lot of roses" was gathered by Mrs. Bishop at Watford.

The last plant on the list, the ivy, was eight days late in coming into flower.

The swallow took its departure two days later than its mean date for the previous eleven years.

VII.

SOME HERTFORDSHIRE SCALE-INSECTS.

By John Hopkinson, F.L.S., F.G.S., F.R.M.S., etc.

Read at Watford, 21st April, 1903.

There are frequently to be seen on oranges, and occasionally on lemons, little light or dark brown or black spots, circular or oval in outline and flatly conical in form. If a fruiterer be asked what they are he will probably say that they are seeds which have accidentally stuck to the fruit. They are not, however, of vegetable origin at all, nor is there anything accidental in their attachment. They are minute insects which are living upon the juices of the fruit; they are, in fact, coccids or scale-insects, the Coccidæ forming a family of the Hemiptera–Homoptera, which include the Aphididæ, Cicadidæ, and some other less-known families, and, with the Hemiptera–Heteroptera, constitute an order (Rhynchota) of the haustellate Insecta. The scale-insects which are commonly seen on the rind of the orange belong to two species of the genus *Parlatoria* (*P. pergandii* and *P. zizyphi*), the latter being most frequent on the Tangerine and Seville varieties, but species of other genera (*Aspidiotus* and *Mytilaspis*) also occur.

The insects of the order Rhynchota have suctorial mouths, and these the coccids fix upon their food-plant where the sap flows most freely. It is, however, only the female coccid which has a mouth, and she is wingless; for the absence of a mouth in the male coccid he is compensated, usually, by the possession of two wings, which he so little values that he has not been observed to use them voluntarily; and throughout their very peculiar metamorphoses, the males, when the larval stage is passed, differ greatly from the females. The eggs are always protected, the shield-like scale which covers those of some species having given to them their popular name of "scales," and the loose cottony material of others being responsible for the popular term applied to them of "mealy bugs." The female lays eggs only once in her lifetime, but that is often enough for their rapid propagation, a single brood varying in number from about 20 to upwards of 2,000. It will thus be seen that the life-history of the coccids is peculiar and of great interest, the metamorphism which they undergo being different from that of any other insects.

I have mentioned the occurrence of the scale-insects upon the orange and lemon as an example familiar to everyone, but they also occur on other fruit, and on the stems and leaves of plants, from the delicate maidenhair fern to the sturdy forest oak, and as they live upon the juices of the plant they are in all cases detrimental, and frequently they are injurious to the extent of killing the plant which they attack.

They are not, however, entirely unprofitable insects, for they include the cochineal insect (*Coccus cacti*), which affords a rich crimson dye, of great value before the discovery of aniline dyes, but now used for little else but dyeing rich silks and colouring confectionery; a species of *Kermes*, resembling a large crimson holly-berry, also imported for its dye; the lac insect (*Tachardia lacca*), which furnishes the very valuable shell-lac of commerce, chiefly used as the basis for varnish and polish; and certain Chinese and Indian insects (*Ericerus pe-la* and *Ceroplastes ceriferus*, etc.), which secrete a pure white wax that in those countries is made into candles for special occasions.

Some Hertfordshire records having come under my notice in the course of passing through the press, for the Ray Society, the second volume of a work by Mr. Robert Newstead on 'The Coccidæ of the British Isles,' from which work the above information is almost entirely derived, I thought that an enumeration of them might be of interest to our members; and having acquainted Mr. Newstead with my intention he has favoured me with a few Herts records not mentioned in his work, and has also offered to lend me some specimens for exhibition this evening.

The species met with in Hertfordshire may be conveniently divided into two groups—those which occur in the open, chiefly on our forest-trees, and those which occur under glass, chiefly on their exotic food-plants imported into this country.

The localities given by Mr. Newstead in our county for the outdoor species are St. Albans, King's Langley, and Tring. That no other localities are given is merely because these insects have not been searched for elsewhere, for doubtless those which have been observed at these places occur more or less freely all over the county. The species are as follows:—

Mytilaspis pomorum.—This species is common everywhere as a great pest on the apple, and it occasionally occurs as a pest on the pear. Its food-plants are many, for it is a general feeder. The recorded Herts localities are St. Albans and Tring, where it has been seen on apple and cotoneaster. For keeping down its numbers we have chiefly to thank the blue-tit (*Parus cæruleus*), but the marsh-tit (*P. palustris*) and the tree-creeper (*Certhia familiaris*) also feed upon it. It is one of the most destructive of the coccids.

Lichtensia viburni.—This is partial to the ivy, but it also occurs on laurustinus (*Viburnum tinus*), whence its name. It has been observed, but only sparingly, at King's Langley and Tring. It is essentially a British species, being only known to occur elsewhere at Montpelier in France.

Lecanium bituberculatum.—The food-plant of this scale-insect is the hawthorn (*Cratægus oxyacantha*). Although a very local species, Mr. Newstead has found it to be plentiful at St. Albans, King's Langley, and Tring. It is a southern form, being common in the south of Europe and not being known further north in the British Isles than Heacham in Norfolk.

Lecanium capreæ.—This is an abundant and widely-distributed species throughout England. It is a rather general feeder, and so destructive that it has been known to kill large patches of a hawthorn hedge. It occurs at St. Albans.

Asterolecanium variolosum.—This species is exclusively confined to the oak (*Quercus robur*), on which it has been found at St. Albans, King's Langley, and Tring. It is very largely preyed upon by the blue-tit (*Parus cæruleus*). At Sydney, New South Wales, owing to the absence of the Paridæ, it occurs in abnormal numbers on the oaks in the Botanic Gardens, causing the leaves to wither at the tips and the young shoots to die.

Apterococcus fraxini.—As the name of this species implies, its food-plant is the ash (*Fraxinus excelsior*), on which it occurs exclusively. It has been observed at St. Albans, King's Langley, and Tring, but is comparatively rare in these localities. The insects fix themselves in the cracks and crevices of the bark of the trees, giving preference to the trunks of young trees and the smaller branches of old ones.

Cryptococcus fagi.—The name of this species also indicates its food-plant, the beech (*Fagus silvatica*), to which it is exclusively confined. It is an abundant species, and one of the most destructive of our native coccids. Badly infested trees seldom recover.

All the above species are probably indigenous. The following, which occur under glass, have been introduced with their food-plant, and therefore are not truly Hertfordshire species :—

Aclerda japonica and *Antonina socialis.*—These two species were found living in company beneath the leaf-sheaths of a newly-imported bamboo (*Arundinaria japonica*) at Broxbourne, and they are not known to occur elsewhere. *Aclerda japonica* causes the leaf-sheaths to swell out at the parts which cover the insect.

Ceroplastes cistudiformis.—This occurs on an orchid (*Chrysis bractescens*) at Tring Park, where it is cultivated on account of its beauty. It does not appear to increase in numbers or to injure the plant to any appreciable extent. It was originally discovered on an orchid at Harrow.

Lecanium persicæ.—This species occurs chiefly on peach, nectarine, and rose, rarely on the vine. In this country it is most abundant under glass. It has been observed at Tring Park.

Mr. R. Newstead's work, from which these particulars of the scale-insects which are known to occur in our county are taken, is comprised in two volumes, the first of which has been published, the second being in the press.* Upwards of eighty plates, most of which are coloured, illustrate it. His account of the life-history and habits of the various species is most interesting, and while the species in all their various stages are minutely described, the work is of practical value to the fruit-grower and horticulturist, who will find in it the most approved methods of prevention and remedy fully treated of, and will learn from it what are the natural

* This was issued to the members of the Ray Society in October, 1903.

enemies of the Coccidæ which they may have to rely upon to keep down their number.

I have to-day received from the author several specimens to exhibit, and also mounted specimens of one species (*Lecanium bituberculatum* on *Cratægus oxyacantha* from King's Langley) for the Herts County Museum. The other species are *Parlatoria pergandii* on orange and lemon, *P. zizyphi* on lemon, *Mytilaspis pomorum* on apple, *Apterococcus fraxini* on ash, and *Cryptococcus fagi* on beech. On one orange there is a quantity of soot-fungus set up by honey-dew secreted by the coccid *Dactylopius citri*. In an accompanying letter Mr. Newstead says that he would be delighted to name any coccids which our members may send to him at any time, and would also willingly mount them for the Museum. The specimens should be addressed to him at the Grosvenor Museum, Chester.

P.S.—Since this paper was read I have been informed by Mr. Newstead that he has received from the Editor of the 'Gardener's Chronicle' specimens of *Lichtensia viburni* (female) which were found at Poles Park, Ware, on 10th July, 1903, on ivy "growing on poles in the open."

VIII.

NOTES ON THE HABITS OF SOME OF OUR LEPIDOPTEROUS INSECTS.

By Arthur Cottam, F.R.A.S.

II.—The Larger Moths.

Read at Watford, 18th November, 1903.

In my previous paper (Vol. XI, p. 222) I confined my remarks to our butterflies, which number only 65 or 66 species. Our British moths number about 2,000 species; and it is a much more difficult matter to give anything like a general idea of the habits, which vary a great deal, in so large a number of insects.

The whole of our moths are, as I stated in my first paper, included under the general head of "Heterocera," that is, having variously-shaped horns. The antennæ are exceedingly variable in form, but are never clubbed like those of the butterflies.

The Lepidoptera are divided, by collectors at all events, into Macro- and Micro-lepidoptera, the large and small species; but this is, after all, an artificial and inexact division, many of the macros being smaller than numbers of the micros.

The larger moths included in the Macro-lepidoptera are systematically divided into four principal groups, and it is to these groups that I shall confine this paper. They are:—

1. The Sphingidæ, or Hawk-moths. This group is again divided into three families, which appear to have but little in common. (*a*) The Hawk-moths proper—17 species. (*b*) The Clearwings, so called because a large portion of their wings is devoid of scales—14 species. (*c*) The Foresters and Burnet moths—9 species. Together 40 species.
2. The Bombyces—110 species.
3. The Noctuæ—300 species.
4. The Geometræ—280 species.

I give the number of species in each group in round numbers. The four groups therefore include about 730 species of moths. The Micro-lepidoptera include about 1,300 species; many are exceedingly small, and among them are some of the most brilliant and beautiful of all our moths.

It will save repetition if, before entering upon the peculiarities of the various groups, I describe the structure of a larva.

The larvæ of all lepidopterous insects have thirteen segments, of which the head forms the first. Segments 2, 3, and 4 each bear a pair of true jointed legs, corresponding to those of the perfect insect. There are also generally ten prolegs situated in pairs on segments 7, 8, 9, 10, and 13. The variations from this typical arrangement will be referred to where necessary as each group is considered.

There is one habit amongst the larvæ of some of the moths of

which there is no instance amongst the butterfly larvæ: instead of feeding on the leaves or flowers of plants, they feed under the bark or on the pith or wood of trees and shrubs, or in the stems and roots of herbaceous plants. These larvæ are known as internal feeders, and there are examples of this habit in each of the groups before mentioned except the Geometræ.

Now to take the groups in order. The hawk-moths proper are the largest and most powerful of our moths. The death's head and the convolvulus hawk-moths measure five inches, and sometimes more, from tip to tip of their wings when spread. All our species have long, thick bodies, tapering to a point, and the wings are narrow for their length, and pointed; fitted, therefore, for rapid and powerful flight. Most of the species have the proboscis abnormally developed, and they feed, not like the butterflies resting upon the flowers, but hovering over them. One genus is called *Macroglossa* (large-tongued), and one species of this genus, the humming-bird hawk-moth, is known to most people. It frequents gardens, and on hot sunny days, especially in the afternoon, may be seen hovering over the flowers and thrusting its long proboscis into them, darting from flower to flower with marvellous rapidity. But the convolvulus hawk-moth has the longest proboscis of all our species, sufficiently long to enable it to suck the honey from the long tubular flowers of the white tobacco plant (*Nicotiana affinis*), which has a great attraction for it. The movement of the wings as the insect hovers is so rapid that they are invisible, and make a distinct humming sound. If you watch one in the dusk it looks like a grey cloud. If frightened or disturbed it vanishes instantly; its flight is so rapid that the eye cannot follow it. The proboscis of this species is almost double the length of the creature's body, and the pupa has a large projecting loop in front to contain it.

The larvæ of the hawk-moths are large and very handsome; most of them have a horn on the 12th segment, pointing backwards. That of the privet hawk-moth is probably known to most people. It is not infrequently found in gardens, feeding on privet or lilac. When full grown it is three inches long, bright apple-green with oblique stripes on its sides, white-edged with lilac above, and with a large curved horn. The moth often measures $4\frac{1}{2}$ inches across the spread wings, and the pupa of this species has also a case for the proboscis, but not so large as that of the convolvulus hawk-moth.

The larvæ of some of these moths have the power of retracting the anterior segments. That of the elephant hawk-moth is a very striking creature, and when stretched out its long tapering anterior segments look like the snout of a hog, and it has two large round eye-like spots situated on the 5th and 6th segments. When the anterior segments are drawn in, those receiving them are puffed out, swollen, and wrinkled, and the two eye-like spots upon them look glaring and conspicuous. It looks a formidable object, while in reality it is perfectly harmless.

A few of the hawk-moths are double-brooded; all hybernate as pupæ underground in a cocoon.

The clearwings are connected with the hawk-moths proper by the before-mentioned genus *Macroglossa*, two species of which have the central portions of their wings denuded of scales. These are the two bee clearwings, so called from their resemblance to humble-bees, especially as they hover over flowers very much as bees do. These two species, when they first emerge from the pupa, have the central portion of their wings covered with large scales, so loosely attached that they very soon rub off.

The larvæ of the true clearwings are all internal feeders; they are soft and maggot-like, without bright colours; most of them spend the Winter as larvæ, and many take two years to become full fed. The pupa remains in the burrow of the larva until the moth is ready to emerge.

Few of our species are common, and they are probably frequently overlooked in consequence of their resemblance to bees, wasps, and other hymenopterous insects. The commonest is the currant clearwing, which feeds in the shoots of currant bushes and may often be seen in gardens.

In all classes of insects there are some that are local, that is, they are only to be found in certain particular localities, and often without any apparent reason. Amongst our clearwings there is a curious instance of this, *Sesia chrysidiformis*, the larva of which feeds in the rootstock of sorrel and dock. Both plants are common everywhere, and yet this moth is only found in this country on the slopes of the Warren between Folkestone and Dover.

The third subgroup of the hawk-moths contains the foresters and burnet moths. Most of these are very local, and one only is common, the six-spot burnet moth. This brilliant green and crimson moth flies in the sunshine on banks, especially near the sea, and must be well known to everyone. The flight is slow and heavy.

All the species fly in the hot sunshine, most of them hybernate as larvæ, and the cocoon is of yellowish tough silk attached to a stem of grass or other low-growing plants.

The next group, the Bombyces, is a difficult one to describe; it is such a heterogeneous group. Mr. Barrett says of it: "By no means largely represented with us, in consequence of which the passage from one family to another is, apparently, even more abrupt than where some of the gaps are filled in by the multitude of exotic forms. Distinctive and reliable characters can hardly be furnished, but the forewings are usually blunt and hardly triangular, the bodies are also usually blunt at the end. The antennæ in certain families reach the utmost development of pectination, in others they are simple and threadlike."

I must therefore pick out a species here and there which has something specially interesting or peculiar about it.

In this group some of the larvæ are internal feeders; that of the goat-moth is a well-known instance. The larva is a repulsive-looking, ill-smelling creature, which feeds in the solid wood of various trees, and takes three years to feed up before turning to

a pupa. It has immensely powerful jaws, and Mr. Barrett mentions a case of a larva of this moth having been shut up in a wooden cigar-box and placed on the top of a pianoforte; being left there, it gnawed its way through the bottom of the box and through the polished wood of the instrument, and escaped.

Another wood-feeding larva is that of the wood leopard moth, which feeds in various fruit-trees and in the wood of the white poplar. It is less like a maggot than most of the internal feeders; it is yellow, covered with black spots. The larva is much more common than the moth, which is comparatively rarely taken in the country, but more often in towns. The reason for this is that the larva is a very favourite food of the woodpeckers, which dig it out of the tree in which it is feeding, and as there are no woodpeckers in towns, the insect is there able to complete its transformations. Euston Square, where there are a good many white poplars, is a well-known locality for this moth, and it is often taken at Ealing. The larva is common in gardens and orchards in the neighbourhood of Watford, and has often been brought to me, but I have not seen the moth.

This group contains many brilliant and beautiful insects; the various tiger-moths, the eggars, and the emperor may be mentioned.

With reference to the last-named, I may mention a peculiarity in the development of the wings. This process is one which I have not before described, but it is carried out by all Lepidoptera in much the same way. When the imago emerges from the pupa-case, the wings are very small and are folded close against the body; they are soft, and the scales are all standing on their edges. The insect at once climbs up to some projecting twig or other place, which enables it to let the wings hang down vertically. It then forces the juices out of its body into the veins or nervures of the wings, which are hollow; the wings gradually expand, and when fully expanded get dry and firm, the scales now being laid down upon their surface. When the wings are quite dry and stiff the insect can use them for flight.

The cocoon of the emperor-moth is in the shape of a flask, and is made of strong inelastic silk. The neck of the flask through which the imago has to escape is very small compared with the size of the insect, and it will not stretch at all. The moth has to force its way, apparently with great difficulty, through the narrow opening, and the pressure upon its abdomen appears to be necessary to enable it to force the juices into the wing-nervures and so to expand them. A lady once, watching the process, thought to release the moth from its difficulties by carefully cutting open the neck of the flask, but the result was that the insect was unable to develop its wings, and was a cripple unable to fly. The lady said it seemed to her an excellent illustration of a creature being "made perfect through suffering."

Many of the larvæ of moths in this group are ornamented with tufts of bright-coloured hairs, or are entirely covered with them.

The brown hairy larva, commonly known as the "woolly bear," is that of the beautiful tiger-moth; and there is one genus containing only two species, in which the larvæ are furnished with tufts of exquisitely branched hairs, resembling palms when magnified. These are the vapourer moths, one of which is rare, but the other is very common even in London. The females of these two moths are entirely without wings.

There is a curious tendency with some insects, of which there are instances amongst the Bombyces, to become darker in colouring when they are bred in Scotland or other northern localities. This tendency to melanism, as it is called, has never been satisfactorily explained or accounted for. Melanism sometimes affects the whole colouring of an insect, but sometimes the variation takes the form of darker markings, and some of them quite distinct from those of the normal form. The most striking instance of this is in one of our common ermines (*Spilosoma lubricipeda*), which in Yorkshire and Lancashire varies in a remarkable manner. Usually yellowish with small black spots, it becomes in the north much more yellow with a great variety of black markings, until nearly the whole insect is black, with the wing-nervures and a larger or smaller patch in the centre of the forewings yellow.

Many of the Bombyces are liable to variation, the common tiger-moth furnishing one of the most curious instances.

The Noctuæ form a group contrasting greatly with the Bombyces, for although they are very numerous they are all closely allied in structure and appearance. Mostly dull in colouring, they are usually less generally attractive than either the Bombyces or the Geometers; but to those who study them this group is one of the most interesting. They are thick-bodied, sweet-loving insects, with well-developed probosces, and their penchant for sweets has been largely taken advantage of by collectors to effect their capture. It is for these moths that "sugar"—a mixture of treacle, sugar, and beer, with the addition of a small quantity of rum or essence of Jargonel pear—is painted on trees, etc. The mixture is smeared on the stems of rough-barked trees, on the side away from the wind. All moths fly against the wind, and as the Noctuæ have an acute sense of smell they will come from long distances to sip the sweets provided for them. They sit out of the wind, all round a patch of sugar, taking care not to soil their feet with it, and sip it with their long probosces. On a favourable night I have often seen eighty or more moths sitting round one patch of sugar.

This method of attracting the Noctuæ is not by any means always successful, and it is difficult to find out what are the conditions that are favourable or the reverse. A dark, close night, with a southerly or westerly wind, is usually considered the best, but I have had many a failure on nights that seemed perfect. There are natural sweets which the moths always prefer to any artificial mixture.

In the Spring an early group of the Noctuæ may often be taken in numbers feeding on the blossom of the sallows, and it is useless

to try sugaring for them. Again, when the lime-trees are in flower or the ivy is in bloom, it is useless to sugar. The blossom of the ivy will attract numbers of the autumn moths, and they are easily caught by gently shaking the ivy over an open umbrella (inverted, of course), when the moths will fall into it, helplessly intoxicated.

A few of the genera can never be attracted by sugar, and can only be taken flying over flowers. The *Plusiæ*, for instance, and the *Dianthæciæ*, all the species of which feed upon the pink tribe (*Dianthus*, etc.), must be sought for flying at dusk over those flowers.

Many plants are fertilised by moths, and it is worthy of note that the flowers of these are generally white or of a light colour, which shows in the twilight, and also that, though they may have no scent in the day, they become deliciously fragrant towards evening. The large white campion (*Lychnis vespertina*) and the white tobacco are instances of this.

Many species of the Noctuæ are among our commonest moths, and must be well known to most people. The large yellow underwing and the common gamma or silver *y* must surely be familiar to everyone.

The moths in this group have the upper wings more or less narrow in proportion to their length; the underwings are often more ample and are closely folded under the upper wings, and concealed by them when the insect is at rest. Throughout the group the upper wings have markings of a similar character, more or less distinct. They are three spots, one near the base of the wing, circular or nearly so, which is known as the *orbicular stigma*; a second spot above it is kidney-shaped, and is known as the *reniform stigma*; while a third, which is not always present, is wedge-shaped, and is called the *claviform stigma*. The almost constant presence of two at least of these three markings, sometimes varied in size and often in colour, makes the task of describing them comparatively easy.

Most of the Noctuæ hybernate as pupæ, some as larvæ, and a few in the perfect state. Several of the autumn species that are attracted by the ivy blossom can be taken again in the Spring, after hybernation, at the sallow-bloom.

A few species fly in the hot sunshine, but as a rule the Noctuæ are very sluggish during the day, and exceedingly clever at concealing themselves. They frequently hide among herbage and at the roots of grasses, and it is next to impossible to find or disturb them. I recollect an interesting experience I once had. I had gone up a Welsh valley at the back of Cader Idris, and for about half an hour I saw hardly an insect on the wing. Suddenly the whole hillside was alive with moths, hundreds of them, flying wildly over and among the grass. I found that they were the antler moth (*Chareas graminis*), the larva of which is commonly destructive to the grass on upland pastures. The flight lasted for about twenty minutes, and then, as suddenly as they had appeared, every moth vanished; not one was visible, and although they had settled down and hidden themselves in the grass, it was impossible

to find one anywhere. I have occasionally taken this moth on the Downs at Aldbury.

Another method of concealment is to sit upon some surface the colour of which resembles that of the moth's upper wings. One morning, two or three years ago, I saw four of the large red underwings sitting upon an oak fence at Watford. The grey colour of their upper wings is extraordinarily like that of a fence which has become weather-stained. The brilliant underwings are, of course, entirely hidden when the moth is at rest. I called a young friend of mine, who happened to be near, and asked him to examine the fence and see if he could find a moth sitting upon it. After walking slowly along it and looking over it carefully, he confessed that he could not. When I told him there were four, and showed him the size of them, he was not a little astonished.

The fourth group, the Geometræ, or Geometers as they are commonly called, are very different from the last. They have thin bodies, even the thorax is small, and they are furnished with much more ample wings, which they can either raise vertically over their backs, as butterflies do, or lay flat as other moths do.

The wings are thin, and can be laid so close to whatever the moth is sitting upon that when some of the darker species rest in this way upon a tree trunk or a fence, it is often very hard indeed to see them. The markings of the wings of many of them are curiously like moss or lichen, and they are very clever at finding a surface coloured like themselves to rest upon.

The larvæ of the Geometræ differ very much from the typical form. They have the usual thirteen segments, and the six true legs on the 2nd, 3rd, and 4th. But as a rule they are without the first three pairs of prolegs, having only four instead of ten. Their method of progression is therefore by making a series of loops; they bring the prolegs close up to the true legs, then holding by them the larva stretches itself out to its full length, holds by its true legs, and again draws its prolegs forward. From this method of proceeding they are called Loopers or Geometers, because they seem to measure the earth as they go. They have also a peculiar attitude when at rest: they hold to a branch, generally a small one, of the tree or shrub upon which they feed, and then stretch themselves at full length at an angle from the branch. In this position their resemblance to a twig is marvellous, and it needs a sharp eye, even with a knowledge of this habit, to find them.

Many of the larvæ have a spinneret beneath the mouth, from which a fine silk is produced, and they are often seen hanging from trees by their silken web.

The Geometræ are an extensive group, but they are not usually to be attracted by sugar or other sweets; some of them will occasionally come to sugar, but they must as a rule be taken flying at dusk. The majority of them hybernate as pupæ, which are generally on the surface of the ground or spun-up on trees. Most of the Thorns pass the Winter in the egg state. Very few hybernate as larvæ, and with them the dormant condition is only

partial, as they seem always ready if there is a little warm weather to revive and feed a little.

I have before mentioned the tendency to melanism amongst insects bred in the north. There are a good many instances of this among the Geometræ, but I will mention only one.

About fifty years ago—no exact record seems to have been kept—a black variety of the common peppered moth (*Biston betularius*) was taken in the neighbourhood of Manchester, before which time it was quite unknown. Since then this variety has become more and more common, and has spread all over the country. At the present time both forms are equally common. Another curious thing about it is that the moth seems at the same time to have increased in size. I have taken dark specimens, though not so black as the Manchester form, in this neighbourhood.

Another species of the same genus, *Biston hirtarius*, has some curious habits. Its favourite haunt in this country is London, and it may be found in abundance in the squares, parks, and suburban roads, particularly those planted with lime and poplar trees. It is occasionally taken in the country, and then generally attracted by a strong light, but in London light seems to have no attraction for it. It is very rare to find one sitting on a street lamp, though it may be found on a tree close by. It is on the wing in March and April, and has a habit of sitting for days and nights on the same tree without moving, its wings laid flat close to the bark.

There are a good many species in this group in which the females have either very rudimentary wings or none at all. These are generally species that are out in the late Autumn or early Winter. The females are found sitting or running about upon the stems or twigs of the food-plant, and they lay their eggs during the Winter, the larvæ hatching out in the Spring when there are some buds or leaves to feed on.

I must not conclude without some further remarks upon the attraction of light. It provides a method that may be used to attract moths of all kinds as well as other insects.

The fascination of light is evidently an unnatural one, for insects try to avoid it and will hide in any dark corner after being drawn to it.

All moths appear to have two periods for flight, one early, as soon as it is dusk or even before, and another later in the night. Light appears to have very little attractive power early in the evening; the best time is during the second flight from 11 to 2 in the morning.

The more powerful the light the better, the best of all being the electric arc-light. This will even attract moths comparatively early in the evening.

The next best I believe to be a powerful oil-lamp. This method is by far the best for collecting in the Fen districts. I have a lamp with four burners giving a splendid light, and when I am in Norfolk among the fens and reed-beds there, we fix this on the top of the mast in a lighter, and slowly punt (or quant, as they

call it there) down the river. The number of moths which are attracted by it on a favourable night is a sight to see.

We once tried an acetylene lamp, but it was an entire failure. We saw moths in plenty, but they would not come near the light; and I believe that the disagreeable smell of the gas kept them away. I have before mentioned the extremely acute sense of smell with which moths are endowed, and I can imagine no other cause for the failure of this light to attract. A collector in Ireland had a similar experience.

There is one other peculiarity about the effect of light; it hardly ever attracts the females, and this method of collecting is almost useless except for the males. I do not say that the females are never attracted, but it is quite the exception to get them by means of light.

IX.

THE CLIMBING AND TWINING PLANTS OF THE SOUTH MIDLANDS.

By James Saunders, A.L.S.

Read at Watford, 29th March, 1904.

It is intended in the following paper to enumerate the species, and describe some of the peculiarities, of the climbing and twining plants which are to be met with in this district, making only such references to exotic forms as may be necessary to the adequate illustration of the subject.

The leading idea of the scandent habit in plants is the acquisition of the power to reach the light and air with a minimum expenditure of energy and of formative material. This is attained by an unequal growth of the opposite sides of an axis, and by a revolving movement of the apex known as circumnutation, or by the development of tendrils, which may be modified foliar organs or specialized branches.

Some of the species that possess one or more of these peculiarities are annual, perishing after a brief existence; examples of these are furnished by the Fumitories. Others are perennial and possess a permanent rootstock, the stems dying down to the surface every Autumn. Such species develop their branches very rapidly in the Spring-time, and, as in the case of the Bryonies, they are able in a few weeks to reach the top of the hedgerows, from the base of which their annual growth has commenced.

The primary internodes of climbing stems do not possess the power of twining. (See Sach's 'Text-book of Botany,' 2nd ed., p. 862.)

Other peculiarities of the scandent habit are the suppression or subversion of the forces of heliotropism and apogeotropism, which usually govern the growth of the ascending axes of plants. By the influence of heliotropism the stems as well as the upper surfaces of leaves turn towards the incident light; by apogeotropism the ascending axis grows erect, or as nearly so as its environment permits. The adventitious roots of the ivy stem furnish an illustration of negative heliotropism, in that they turn from the light in their efforts to attach themselves to the object near which they are growing. Another familiar example of this habit is the graceful creeper *Ampelopsis Veitchii*, of Japanese origin, which has become thoroughly acclimatized in this country.

For convenience climbing plants may be grouped according to the organs which are modified for that purpose.

Stems.—The circular movement of the stem in its endeavour to find a support is limited to the upper portion, usually to the last two or three internodes. The length of time occupied in making a single revolution varies in different genera, and is also influenced by

changes of temperature. When external conditions are favourable the circular nutation of the free apex is usually uniform. In the hedge bindweed, *Convolvulus sepium*, Darwin records 1 hour 42 minutes as the time occupied in effecting one revolution, and in the garden bean, *Phaseolus vulgaris*, 1 hour 55 minutes.

The *torsion* of the stem is quite distinct from circular nutation, although they coincide in direction. This correspondence is conspicuous in the hop and the honeysuckle, but in the latter it is much more pronounced in the primary axes than in the branches given off by them. Torsion is apparently imparted to the older internodes in order that they may be strengthened and thus enabled to support the younger portions until the apex has secured a point of attachment. When contact with a supporting medium has been effected, growth becomes vigorous, and formative materials are copiously supplied to the organs that are thus performing their legitimate functions. When the black bryony has overtopped a hedgerow, and thus raised itself above other means of support, several stems twine round each other and form a cable, which enables them to rise still higher, until they bend down by the weight of their own growing parts.

Stems, in twining round suitable supports, move either to right or to left, and all the species of the same genus usually assume the same habit, or rather they exhibit hereditary tendencies, which are due to common ancestry. Those that move from left to right, that is, with the sun, or with the hands of a watch, are described as sinistrorse, while those that move in a contrary direction, that is, right to left, are said to be dextrorse.

Of the latter, familiar examples are furnished by the hop, honeysuckle, black bryony, black bindweed, and the bittersweet. Of the last mentioned, Darwin remarks that "the habit is not constant."

The bittersweet is shrubby in habit, and is better able to support its own weight than the others just enumerated. Consequently the climbing habit is not so strongly developed as in the other twining plants of this district. It is most marked in plants of this species that have a slender habit resulting from growing in company with tall herbage. When occurring in open situations they are more compact, and occasionally several stems form a slightly twisted cable.

The wild honeysuckle, which is common in this district, is frequently found growing in company with hazel. It sometimes happens that a primary stem of honeysuckle attaches itself to a vigorously growing shoot of the latter. The tension of the honeysuckle upon the tissues of the hazel becomes very pronounced as the growth of both proceeds. An illustration of this was observed in a thicket at Woodside, Beds, in January, 1904. The hazel stem had attained a diameter of nearly two inches, whilst that of the honeysuckle was half an inch. The constriction of the latter upon the former was so great, that a considerable swelling was produced where the two were united, which showed as a sinuous

line from right to left for several feet on the stem of the supporting plant. As the extra deposition of woody tissue was above the line of contact, the inference is that the formative material was arrested in its downward flow.

Familiar examples of twining stems that turn from left to right are furnished by the scarlet-runners (*Phaseolus*) of cultivation, and the bindweeds, including the field convolvulus and the large white hedge convolvulus, both of which are common in our neighbourhood. In the latter the rootstocks are underground, and as the stems are annual and slender they cause but little injury to the plants around which they climb. The field convolvulus is, however, detrimental to cereals.

Associated with the *Convolvuli*, of which they are specialized offshoots, are the leafless, parasitic dodders. These are annuals, and attach themselves to various herbaceous and shrubby plants from which they draw nourishment by means of sucker-like organs (*hausteria*) which are developed on the stems and assume the functions of roots. Although so closely allied to the *Convolvuli*, they have diverged from the habit of that genus of turning from left to right. The dodders have no definite mode of growth, turning, twisting, and doubling back in every direction, for which habit the most descriptive term is "scramble." Wherever food can be obtained with least effort, to that point growth is directed. The species that occur in the South Midlands are: *Cuscuta trifolii*, which is sporadic in clover-fields and is too frequently introduced with foreign seeds; *C. Epithymum*, which occurs occasionally on sandy heaths attached to ling, thyme, etc.; and *C. europea*, which is rare with us, growing on nettles, etc.

In the common ivy (*Hedera Helix*) the stems develop a great number of adventitious roots by which the plant adheres firmly to any means of support that is available, such as walls, fences, and living trees. When it attains a vigorous growth on deciduous trees, its perennial foliage checks the development of the leaves of the host plant. It is also probable that the constriction caused by the adhesion of the stems and branches of the ivy retards the flow of the sap of the tree to which it is attached, and hence diminishes the supply of nutritive material to the growing extremities.

The *twining* habit of the common ivy occurs occasionally in ancient hedgerows which have not been cut down for forty or fifty years. An illustration of this exists at Chaul End, on the borders of the adjoining counties of Beds and Herts. There are several instances of ivy twining round stems and branches of blackthorn, hazel, and maple. The twining is indiscriminate, sometimes complicated, and occasionally becoming reversed in the same axis. In one instance, associated with blackthorn, an ivy stem $1\frac{1}{4}$ inch in diameter accomplished two complete spirals from right to left, on the main axis, which was followed by another in the opposite direction on a short lateral branch. (See Fig. 20, p. 65.) The twining is most pronounced just below the fruiting branches, presumably to give increased support to these organs. The ivy

branches that assume the twining habit, so far as observed, vary in thickness from $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches, and the stems of the various species to which they are attached range from an inch to 5 or 6 inches in diameter.

The largest stem, that of maple, around which ivy was seen to twine, did not exceed 6 or 7 inches in thickness. In the immediate vicinity were tall trees of beech, ash, and oak, from 18 inches in diameter and upwards, but in all these instances the ivy that grew on them climbed without twining.

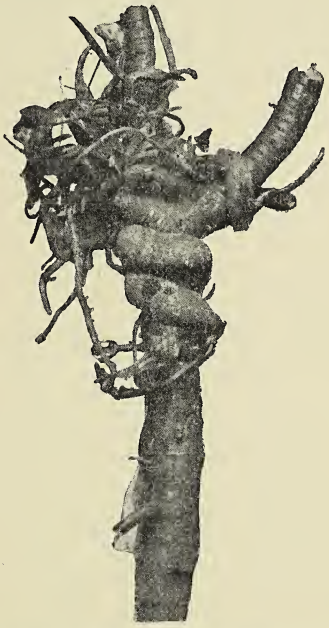


Fig. 20.—Ivy twining round blackthorn at Chaul End, Beds (Feb. 1904), one-sixth natural size. Most of the leaves of the ivy have been cut away.

It is a curious fact that twining stems fail to attach themselves to supports that are too large for the purpose; the maximum size appears to be determined by the dimensions of the coil which the stem can produce without such assistance.

In asparagus the main axis, when young, possesses the power of twining. Some exotic species of this genus have true twining stems. (Brown's Botany, p. 582.)

Petioles.—The British species that climb by means of petioles are fewer than those that do so either by the stem or by tendrils. A well-known example of this method is furnished by the wild clematis, which is so abundant over the Chalk district. The curvature of the petiole is induced by contact with any means of support; those leaves that do not receive this stimulus have the

rachis straight or nearly so. When contact with a support is obtained, the rachis twists and turns in various directions, sometimes effecting a complete revolution in which it necessarily carries with it the terminal leaflet. Sometimes the petioles of leaves on different branches of the same plant twine round each other, thus securing mutual support. The peculiarities here referred to are common both to the British wild clematis and to the exotic species which are introduced into gardens.

In the Fumitories that have come under the writer's observation, the twining habit affects both the rachis of the leaf and also the leaflets. This has been noticed in *Fumaria officinalis*, a very common form of the Chalk area. The allied species *Corydalis claviculata*, a plant of woodlands, most frequent on sandy soils, illustrates the transition from leaf-climber to tendril-bearer, its tendrils producing diminutive leaflets.

The exotic plant *Cobea scandens*, which is a favourite flower of floriculturists, has leaves composed of one pair of leaflets above which the rachis is continued as a branched tendril.

Tendrils.—These may be either a modified branch or modified foliar organs. Examples of the former are furnished by vine, Virginia creeper (*Ampelopsis*), and white bryony, in all of which the tendrils are leaf-opposed, or extra-axillary. In white bryony the tendrils are simple; in vine and *Ampelopsis* they are compound.

The growing points of the tendrils of vine possess the power of rotary motion for a limited period, the movement being most pronounced during a warm afternoon. If they secure a point of attachment, the tendrils speedily twine themselves round the support, which is succeeded by a considerable increase in size from the growth of woody tissue. If after several days they fail in securing a means of support, the organ becomes atrophied, dwindles in size, and eventually falls off. This peculiarity also affects the tendrils of other climbers, as Virginia creeper and white bryony.

In Veitch's creeper (*Ampelopsis Veitchii*) the small branched tendrils are presumably affected by negative heliotropism, since they turn towards the support near which they are growing, and hence away from the incident light. The tips of the branches of the tendril develop small fleshy discs which adhere so strongly that when pulled the tendril will more frequently break than become detached. It is necessary that the surface up which it is desired they should climb should be slightly rough to enable the discs to adhere. They are unable to ascend a stucco wall painted so as to be quite smooth. A conspicuous failure under these conditions occurred at Putteridge Gardens, near Lilley, Herts. The tendrils of white bryony are unbranched; these, when they have secured a point of attachment, speedily contract by means of a double series of spirals, about one half of which turn in one direction and the other half in the opposite. The point of divergence is clearly indicated near the middle of the organ. Other illustrations of simple tendrils are furnished by various members of the cucumber tribe, to which group the white bryony belongs.

List of Local Climbing Plants.

(See also 'Trans. Herts Nat. Hist. Soc.,' Vol. I, p. 68.)

STEMS.

Araliaceæ . .	*Hedera Helix*	Ivy.
Caprifoliaceæ .	*Lonicera Periclymenum* . .	Honeysuckle.
Convolvulaceæ	*Convolvulus arvensis* . . .	Bindweed.
	C. sepium	,,
	Cuscuta Epithymum . . .	Dodder.
	C. europea	,,
Solanaceæ . .	*Solanum Dulcamara* . . .	Bittersweet.
Polygonaceæ .	*Polygonum convolvulus* . .	Knotgrass.
Urticaceæ . .	*Humulus Lupulus* . . .	Hop.
Dioscoreæ . .	*Tamus communis*	Black Bryony.
Liliaceæ . .	*Asparagus officinalis* . . .	Asparagus (occasionally).

PETIOLES.

Ranunculaceæ.	*Clematis vitalba*	Wild Clematis.
Fumariaceæ .	*Fumaria officinalis* . . .	Fumitory.
	F. densiflora	,,
	Corydalis claviculata . . .	,,

TENDRILS.

Papilionaceæ .	*Lathyrus Aphaca*	Vetchling.
	L. pratensis	,,
	L. sylvestris	,,
	L. macrorrhizus	,,
	Vicia tetrasperma	Vetch.
	V. gracilis	,,
	V. hirsuta	,,
	V. Cracca	,,
	V. sylvestris	,,
	V. sepium	,,
	V. lutea	,,
	V. sativa	,,
	V. angustifolia	,,
Cucurbitaceæ .	*Bryonia dioica*	White Bryony.

PRICKLES.

Rosaceæ. . .	*Rubus*	Blackberry.
	Rosa	Wild Rose.
Urticaceæ . .	*Humulus Lupulus*	Hop.

ADVENTITIOUS ROOTS.

Hederaceæ. .	*Hedera Helix*	Ivy.

Of the above, certain species show the following peculiarities:—

Stems twining opposite ways in different individuals.

Solanaceæ . .	*Solanum Dulcamara* . . .	Bittersweet.

Stems twining irregularly.

Araliaceæ . .	*Hedera Helix*	Ivy.
Convolvulaceæ	*Cuscuta*	Dodder.

The extensive genera *Vicia* and *Lathyrus* usually possess branched tendrils which are modified midribs of leaves. An extreme case is presented by *Lathyrus Aphaca*, which is sporadic in cornfields, that species having its leaves reduced to tendrils, the office of the foliar organs being effected by an unusual development of the stipules. The leaflets are present on seedlings, but are rarely seen on mature plants. In the closely allied species *Lathyrus Nissolia*, the grass vetch, a very local plant of sandy soils, both tendrils and true leaves are suppressed, the latter organs being replaced by modified petioles which are developed into elongate, grass-like phyllodes.

Hooks.—There are no British plants that climb by hooks which when irritated by contact increase in thickness. Exotic examples of these are furnished by *Uncaria* (Rubiaceæ), *Olax* (Olacineæ), and *Hugonia* (Linaceæ), which are members of natural orders represented by plants that are native in this district. (Sach's 'Text-book of Botany,' 2nd ed., p. 962.)

Prickles. — Another means of obtaining support from more strongly growing plants is attained by means of prickles. These are epidermal developments, and may be regarded as bundles of hardened hairs with pointed apices. Familiar examples are furnished by the brambles and wild roses, in which the prickles are spreading or point downwards. The latter feature is most frequent, especially in the dog-roses, strongly growing stems of which may frequently be seen rising several feet above the general level of country hedgerows.

Minute prickles or climbing hairs occur on the six ridges of the stems of wild hop, and no doubt assist the plant in clinging to any available means of support.

Climbing plants furnish subjects for outdoor observation at all periods of the year. In Spring and Summer the phenomena associated with growth amply repay the closest attention, and in mid-Winter a little discrimination enables one to distinguish the various genera of plants of which the stems are exposed in the leafless coppices and hedgerows.

Addendum.

The Vernal Shoots of Ivy.—The habits of these organs varies in accordance with their environment. Those which grow remote from means of support droop at various angles, while their apices are heliotropic over several internodes. Those which grow close to a support have their extreme tips alone heliotropic, the next older internodes being non-heliotropic owing to the climbing habit having overcome the heliotropic; the internodes near the apex are closely appressed to the supporting medium, that position being maintained until the adventitious roots, by which the adhesion is rendered permanent, are developed.

X

CHEESE-MITES AND SOME OTHER MITES.

By John Hopkinson, F.L.S., F.G.S., F.R.M.S., etc.

Read at Watford, 3rd February, 1904.

The Acari, popularly known as cheese-mites and scientifically as the Tyroglyphidæ, are a small family, having very few genera and not many species. They are of small size, very few species reaching the thirtieth of an inch in length, and only one ever exceeding one-twentieth of an inch. But they make up for fewness of species and smallness of size by the countless numbers in which some of their species occur.

They are exceedingly destructive to dried or preserved food of many kinds, and also to drugs which consist of animal or of vegetable matter. They do not usually attack living plants or animals in a state of health, except bulbs and tubers, but when such a plant as a fungus, especially if fleshy or gelatinous, shows the first signs of decay, it is often attacked by mites which hasten its decomposition. Hay is very liable to attack, and so is flour, and dried fruits and sweet wines often suffer much. Samples of an infested hay-stack, taken at random, have been found to consist as much of mites as of hay.

All the Acarina undergo a metamorphosis, but in the cheese-mites and their allies there is one stage which does not appear to be certainly passed through in any other family of mites, or indeed in any other creatures, the one or two exceptions which have been adduced amongst the Acarina being very doubtful. This is a condition of fasting and clinging undergone in order to secure the wide dispersal of the species in which it occurs, and it is of so much biological interest and economic importance that I think a few minutes may well be devoted to its consideration. It is called the "hypopial stage"; and to discover what this stage actually is has been reserved for the patient investigation of Mr. Albert D. Michael.

The Tyroglyphidæ, like almost all other Acari, pass through four principal stages—the ovum, the larva, the nymph, and the imago. The eggs are usually oval, smooth, and white or light-coloured, and their cuticle cannot be called a shell, like that of many Acari, being soft and capable of expansion. The larva is hexapod, the nymph and imago are octopod, the fourth pair of their eight legs being wanting in the larva. After a short inert period the larva casts its skin and becomes a nymph, the first ecdysis which the creature undergoes. There is usually a great resemblance between the nymph and the earlier and later stages, the larva and the imago. The nymphal stage is the growing period, it is the period between the first and the last ecdysis, and within it occurs the second ecdysis by which the "first nymph" becomes the "second nymph," a period of inertness or torpidity

preceding each ecdysis, by the last of which the nymph becomes the imago. It is in the nymphal stage that the hypopial condition comes in, and a brief summary of Mr. Michael's history of the literature relative to the hypopus, as given in his latest work, the 'British Tyroglyphidæ,' may be of interest.

De Geer, in 1735, noticed on the house-fly some small reddish mites which entirely covered the neck and back of the fly. They were usually quite still, but ran about actively when touched. De Geer considered the creature to be an adult; and Linnæus, in 1758, called this supposed species *Acarus muscarum*, after the fly (*Musca domestica*) upon which it was found.

Passing by the observations of Geoffroy, Hermann, and Schrank, which do not materially increase our knowledge of this stage, we come to Dugès, who in 1834 created the genus *Hypopus*, at the same time throwing out the first hint that the minute mite to which he gave this name might be immature, putting a ? as to whether the creature was a larva. Dufour in 1839 added two supposed species of *Hypopus* which he found upon beetles and flies, and also added a new genus for an allied mite which he found upon bees, regarding them as adult creatures parasitic upon the insects on which he found them.

Again passing by the observations of authors who did not add materially to our knowledge of the hypopial stage, Koch and Gervais, we come to Dujardin, who in 1849 published a memoir which, Mr. Michael says, "was far the most careful study of Hypopus made up to that time," with most accurate drawings. Although he advanced an erroneous hypothesis, he was the first who "proved that Hypopus was an immature form of some Acarus different in appearance from itself." He observed the absence of mouth-organs, and also of reproductive organs.

Fürstenberg in 1861 and Clarapède in 1868 published papers on the Acari, giving the results of very careful observations on the hypopial nymph, but neither of them recognised the creature as such, and it was not until 1873 that the first suggestion was made that this was the case. Mégnin then took the precaution to breed his mites, a species of *Tyroglyphus* feeding on mushrooms, in captivity, and he saw the "hypopus" inside an inert nymph of *Tyroglyphus*, and found that it "turned into a nymph of *Tyroglyphus*." This, he perceived, occurred when moisture was added, and he came to the conclusion that "*Hypopus* was a form into which the nymphs of *Tyroglyphus* changed, when, through dryness of the atmosphere or other causes, there was a difficulty in their continuing to live as *Tyroglyphi*, and that it was a provision of nature to insure the preservation of the species by carrying it over periods of drought, etc."

Memoirs on *Hypopus* were published by J. G. Tatem in 1872, Andrew Murray in 1876, and Dr. P. Kramer in 1877, but they did not contribute towards the solution of the mystery. In 1880, however, G. Haller got even nearer to the truth than Mégnin, suggesting that "the hypopial form is a 'travelling dress' for

Tyroglyphus, to enable it to endure the journey from one fungus, etc., to another, which would sooner or later become necessary from the drying or destruction of the first fungus." In 1881 Berlese published a paper in which he agreed in the main with Mégnin, and added the apparently correct observation that "*Hypopus* does not take any nourishment."

Such was the state of our knowledge when Mr. Michael, in 1884, published the results of his observations in a paper read before the Linnean Society of London.

Mr. Michael commenced his experiments by breeding the cheese-mites, *Tyroglyphus siro* and *T. longior*, in small glass cages, but only with difficulty succeeded in getting the hypopial nymph of one of these species, *T. longior*. In 1881 he found that there was no difficulty in obtaining and rearing the hypopus of another mite, *Tyroglyphus mycophagus*, and the conclusions he drew from his experiments were that from the cast skin of the young nymph, on its first ecdysis, the second in the life of the individual, there sometimes emerges a hypopus, though usually a second nymph; that this hypopus may be either a male or a female; that adverse circumstances, such as drought, do not tend to increase the production of hypopi; and that by an ecdysis, preceded by a period of inertness, the hypopus becomes again a nymph. The hypopial stage is, in fact, an occasional one in the life-history of certain species of *Tyroglyphus* and of some allied genera in which they can withstand great changes of temperature and absence of moisture, and do not require food, and during which they cling to insects or other creatures for the sake of conveyance in order to secure the wide distribution of the species.

There are two or three different kinds of hypopus; in two they are protected by a chitinous cuticle; in one of these they cling to the smooth surfaces of insects, etc., by means of suckers, in the other they attach themselves to the hairs of mammals, on which alone they are found, by means of a short longitudinal furrow in which the hair lies and is firmly secured by clasping organs on either side of the furrow, this type of hypopus being termed homopial. The third type of hypopus, which is termed trichotarsial, is a nymph without a chitinous carapace, but provided, as in the true hypopi, with suckers by which it becomes attached to wild bees of the genus *Osmia*, etc. As no other nymphal stage is known in the mites which assume this form, it is doubtful whether the trichotarsial condition should be considered as truly hypopial, but Mr. Michael inclines to the belief that it is so. Hypopi occur in immense numbers, fifty on one ant being a small number, a single ant in a badly-infested nest sometimes carrying thousands upon it and dying under its burden.

It should here be mentioned that Mr. Michael has conclusively proved that hypopi are not parasites, as they were at one time supposed to be, the death of the ant under these conditions being due to its inability to clean itself with the comb with which its front legs are provided, and to the lethargy into which it falls.

The Tyroglyphidæ, in their adult stage, are of very simple organization. Almost all are soft-bodied; they are without special breathing organs, without a heart, and without eyes, and their palpi, or organs of touch, are less highly developed than they are in many other families, while their mouth-organs also are comparatively simple. They are very active, and do not appear to feel the loss of special organs of sense.

They are not usually considered to be pretty creatures, and yet the commoner of the two cheese-mites, *Tyroglyphus longior*, seen under the microscope with a moderate power and with its smooth carapace reflecting a brilliant light, has some pretensions to beauty; and Mr. Michael says that "A female *Glycyphagus Canestrinii*, well seen with dark-ground illumination and a sufficient amplification, its whole body surrounded by its peripheral row of great ostrich plume-like hairs, all shining like frosted silver, is a sight which will not readily be forgotten by anyone possessed of any appreciation of beauty."

I have taken the foregoing particulars from the first or introductory part (183 pages) of Mr. Albert D. Michael's "British Tyroglyphidæ," a work published by the Ray Society, which has just been completed by the issue of the second volume. The work is illustrated by 42 plates, most of which are coloured, each of the thirty species of mite described being illustrated by one or more figures drawn and coloured from life, while anatomical details, special organs, and dissected parts are uncoloured. The life-history of every species is traced through all its stages from the author's personal observation and that of his wife, who, he says in his Preface, has shared in all his investigations with a "skilful hand in minute dissection and in microscopical preparation, and in the rearing of minute Acari."

XI.

ON THE OCCURRENCE OF *SIREX NOCTILIO* AND *SIREX GIGAS* IN HERTFORDSHIRE.

By A. E. Gibbs, F.L.S., F.R.H.S.

Read at Watford, 3rd February, 1904.

During the Autumn of 1903 instances of the mischief done to timber by the two large saw-flies *Sirex noctilio* and *S. gigas* were brought under my notice.

In September the Instructor at the St. Albans Technical Schools, Mr. J. T. Baily, drew my attention to a trunk of silver-fir which had been purchased from a local firm of timber-dealers for use in the Manual Training School. It was found to be so infested by white, fleshy, tunnel-boring grubs that it was quite useless for school purposes. I asked Mr. Baily to put the wood aside for observation, and in a few days a female specimen of *Sirex noctilio* emerged, and this was succeeded by the appearance of a number of other specimens, the emergences continuing at intervals until the advent of the cold weather. As the insects left the galleries in the wood they flew to light, and were mostly captured on the window-panes, and sometimes three or four were buzzing about at the same time. The galleries excavated in the wood by the grubs ran in all directions; indeed, the tree was completely riddled by them. Enquiries elicited the fact that the silver-fir was grown on the Russells Estate, the property of Mr. Lewis Evans.

Sirex noctilio is the smaller of the two species of giant saw-flies, or tailed wasps as they are often called, which occur in sufficient numbers in this country to be regarded as British insects.

The genus *Sirex* belongs to the Siricidæ, one of the two families into which the phytophagous or vegetable-feeding Hymenoptera are divided. This family can be at once identified by the long powerful ovipositor of the female, which is adapted for piercing the bark of trees in order to deposit the egg in the wood in which the larvæ feed. I may be pardoned for reminding you that the order Hymenoptera is primarily divided into two groups, the Terebrantia or Borers, of which we have a good example in the species under notice, and the Aculeata or Stingers, to which the bees and wasps belong.

The insect with which we have now more particularly to deal is generally known as the steel-blue or "common" saw-fly, though it does not appear to be very abundant in England and is certainly rare in this county. The female has a handsome purple-blue abdomen, terminated by a spike-like projection, which is the ovipositor. The male is a different-looking insect, the abdomen being yellow with a black apex. The eggs having been deposited in a suitable tree by the female, they in due course hatch, and the young larvæ commence to bore galleries in the solid wood. They are fleshy, cylindrical grubs, with strong mandibles, without eyes,

and practically without legs. As it continues its excavation the maggot fills up the gallery through which it has passed with the rejected particles of wood, which are so tightly squeezed together as to necessitate the use of a bradawl or some similar instrument to clear it of the refuse. This can be well seen in the specimens of bored wood which I have brought for exhibition. When fully fed the larva pupates in a cell in the wood, from which the perfect insect, when it emerges, escapes by boring a clean-cut tunnel direct to the open air. Some of the wood at our Technical School had been sawn into planks, and these had been placed one above another against an inner wall of the building, so that after leaving their pupa-cases the imagines had in several instances to bore through a succession of planks to obtain their liberty. The tunnels made by the escaping flies are clearly shown in some of the pieces of wood now exhibited. It is a doubtful point whether the female ever deposits her eggs in a healthy tree. Some authorities tell us that she either selects one which is showing

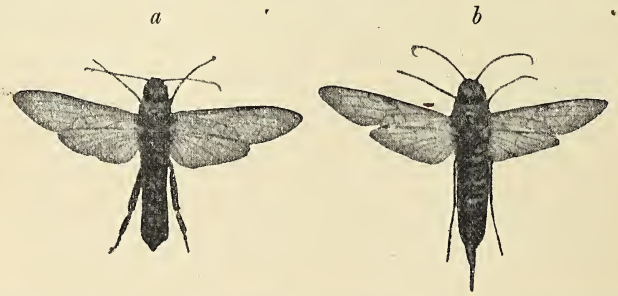


FIG. 21.—*Sirex noctilio*. *a*, male ; *b*, female. Three-fourths natural size.

signs of decay, or places her eggs in a fallen tree. The silver-fir seems to be a special favourite with this species, but several other conifers are liable to attack. In England, although considerable damage is sometimes done to fir plantations, the injury caused is not so serious as is often the case in Continental pine forests.

It will be noticed that I have been calling this insect *Sirex noctilio* and not *Sirex juvencus*, the name by which it is generally known. The Rev. F. D. Morice, writing to the 'Entomologist's Monthly Magazine' for February,* shows that the latter appellation pertains to another species, and that the insects constantly recorded in this country as *S. juvencus* are the *S. noctilio* of Fabricius. The true *S. juvencus* is very rarely found in the British Isles.

During the time that I had *Sirex noctilio* under observation, my co-secretary at the County Museum, Mr. F. G. Kitton, brought to me a female specimen of an allied species, *S. gigas*, which had been killed in his wood-cellar, and a few days afterwards he

* 'Entomologist's Monthly Magazine,' 2nd ser., vol. xv, p. 34.

informed me that quite a number of them, of both sexes, had appeared in the same place. Investigation showed that they were emerging from a heap of fir-wood which had been cut up for fuel. The tree grew in Mr. Kitton's garden, and as it was left upon the ground for some time before it was cut up, the probability is that the eggs were then deposited in it. A piece of the wood, badly tunnelled by the grubs and the escaping flies, was kindly sent to me by Mr. Kitton, and I am utilizing it, and also the wood damaged by *S. noctilio*, in making up a case for the County Museum, to show the destruction that may be done to timber by these insects.

Fig. 22.—*Sirex gigas*. *a*, male; *b*, small female; *c*, female of normal size. Seven-eighths natural size.

Sirex gigas is a larger, and, so far as my experience goes, a commoner species than *S. noctilio*. In the female the base and apical segments of the abdomen are yellow, and the central segments black, giving the insect a hornet-like appearance. The ovipositor is longer than in the first-mentioned species. The male is very similar to the male of *S. noctilio*, but may be at once distinguished by its yellow antennæ. As will be seen from the illustration (Fig. 22, *b*, *c*), the females of this species vary very greatly in size. The late Miss Ormerod expressed the opinion that this variation is influenced by the conditions of the maggots having been favourable or otherwise, instancing some females of large size sent to her from an old silver-fir where everything must have been suitable for growth, as compared with

small specimens from buried wood used to support drain-pipes. It appears probable that Miss Ormerod has suggested the right explanation, but it will be noted that in the present instance the heap of fir-wood in Mr. Kitton's cellar yielded specimens which, so far as size is concerned, exhibit the extremes of variation.

Other species of *Sirex* have been taken in this country besides the two I have mentioned, but it is doubtful if any of them are really British insects. Being wood-feeders the larvæ are easily conveyed from place to place in timber, and there is no doubt that in this way they often travel long distances. The Rev. F. D. Morice, M.A., F.E.S., states that he has met with *S. gigas* in Upper Egypt, where it is certainly not indigenous, and where no doubt it arrived in European timber. It is no uncommon thing for these flies to appear suddenly in new houses, issuing from the woodwork and occasioning alarm among the inmates; and it should further be borne in mind that the larvæ sometimes remain concealed in timber for years before reaching maturity, and in this condition may be conveyed from place to place, making it most difficult to trace the land of their origin.

XII.

ADDRESS.

SOME HERTFORDSHIRE NATURALISTS AND THEIR WORK.

By the President, B. Daydon Jackson, F.L.S., General Secretary of the Linnean Society.

Delivered at the Anniversary Meeting at Watford, 1st March, 1904.

Ladies and Gentlemen,—

You will not expect me to give you any summary of the work of the Society during the past year, as the reports of the Secretaries and of the Treasurer accomplish that most efficiently. I will therefore ask your attention for a short time this evening to an account of "Some Hertfordshire Naturalists and their Work," by that meaning naturalists who have contributed to our knowledge of the flora or fauna of the county, and not necessarily those who have been born within its boundaries.

The subject of my address to you is one which has had great fascination for me during more than thirty years, and if I should have the good fortune to convey to you any part of the charm which it has for me, I shall feel that my efforts have not been unrewarded. I propose to rapidly pass in review some of the bye-gone naturalists who have contributed to our present knowledge of the plants of our county, for I dare not attempt the unfamiliar ground of the zoology as well as the botany of Hertfordshire other than by a mere occasional reference. This will also enable me to add a few records which have still to be placed on the printed pages of our 'Transactions,' having hitherto escaped modern recognition.

We naturally begin with the "Father of English Botany," William Turner. Born at Morpeth about 1510, he resided at Cambridge from about the year 1527 to 1538, filling several offices in his college, Pembroke Hall, and in the last-named year he published the first work of any botanical merit which appeared in this country, the 'Libellus de re herbaria novus.' Soon after this he went abroad, spent some time in Italy, came back through Switzerland, where he visited Conrad Gesner at Zurich, and in travelling through Germany stayed at Cologne. He then seems to have passed into the Netherlands and to have explored the islands lying off the Friesland coast. He had incurred the displeasure of Henry VIII by his writings on religious topics, and his books had been prohibited by that monarch, on whose death, and the subsequent accession of Edward VI, he came home again, and soon

afterwards published his second botanical work: 'The Names of Herbes in Greke, Latin, Englishe, Duche and Frenche wyth the commune names that the Herbaries and Apotecaries use,' London, 1548. This little work contains the solitary mention of a Hertfordshire plant, *Euonymus europæus*, "In moste plentye between Ware and Barkway," showing which road he took in his journey between London and Cambridge, though the station is a long stretch of something like thirteen miles. Three years later he brought out the first part of his 'Herbal,' which was only finished in 1568, the year of his death, by the issue of the third part, a folio book of much interest. He lived a stormy life, divided between theology and medicine, but was a close observer of facts of natural history, which is shown not only by his books just mentioned, but also by his book on Birds, 1543, and his letter to Gesner, printed in Gesner's collected works, in which he informed Gesner of the various British birds known to him. Three of his books have been reprinted in recent years. Our first observer was a capable and sound naturalist, and Ray's opinion of him in his own words is "*Vir solidæ eruditionis et judicii*" (a man of solid learning and judgment).

John Gerard, who comes next in order of time after Turner, offers in many respects a curious contrast. He was a man of slight learning, and author of two books against Turner's 39, but his 'Herball' is known everywhere and exists in three editions. A native of Nantwich in Cheshire, he passed the greater part of his life in London, and being a barber-surgeon, grew in his own garden the plants which he wanted in his craft. But like so many of the early herbalists, he was not restricted in his tastes to those plants only which formed, so to speak, his stock-in-trade. In his limited way he maintained a correspondence with foreigners, and thus procured seeds from abroad for his own garden and those of his patrons and friends. His first venture in print was his catalogue of garden plants, which appears to be the first garden list published; at this time he was superintendent of the gardens belonging to Lord Burleigh in the Strand, and at Theobalds in our county. Two years after this, Paul Hentzner visited Theobalds at the time when Gerard was superintendent, on the very day, 8th September, 1598, when the great Lord Burleigh was buried, and in his 'Itinerarium' he gives an account of the garden as it then appeared. The book by which Gerard is so well known, the 'Herball,' came out in 1597; it is not an original work, but an adaptation of a translation from Dodoens's 'Pemptades,' recast as to arrangement, and with copious notices of the localities of plants

observed by the English editor. Here we find mention of a round dozen Herts plants, and they possess a peculiar local interest from nearly all having been noted "between Bushie and Watford," with two at St. Albans and one at Hatfield. Gerard died in 1611, but his great work was re-edited and corrected by Dr. Thomas Johnson in 1633, and reprinted in 1636. Johnson added nothing to our records himself, but the Rev. Robert Abbot sent him a specimen of the bee-orchis from Hatfield. I cannot find anything more about the man than this solitary fact.

It would have been interesting had we been able to claim the illustrious Francis Bacon, 1st Baron Verulam and Viscount St. Albans, as having added even a single line to our records. I have recently again gone through his 'Sylva sylvarum,' centuries 6–8, in which he discourses of plants, but these sections are to a naturalist very unsatisfactory reading: they form a vast collection of all the sayings about plants and plant-growth he had read or heard, many paragraphs beginning "It is reported," followed by some attempt to account for the phenomena cited by the philosophical conceits of his day; suggestions for new experiments and the like abound, but not a shred of the shrewd remarks which are everywhere present in the pages of the actual observers, such as Turner, Gerard, Ray, Parkinson, and many other smaller men. Bacon was a distinguished resident in our county, but as regards our plants they might never have existed so far as they receive mention in his pages. Garden flowers attracted his attention, but the weeds of the wood and wayside were of but little interest to him.

Before leaving this topic I may give one specimen of the character of the book under notice—

"There is an old Tradition, that Boughs of Oake, put into the Earth, will put forth Wilde Vines; Which if it be true (no doubt) it is not the Oake that turneth into a Vine, but the Oake Bough Putrifying, qualifieth the Earth, to put forth a Vine of it selfe." ('Sylva Sylvarum,' cent. vi, p. 131.) I will refer to this later.

John Parkinson has earned a name of a somewhat different kind to Gerard. He also issued two books, but his first volume was devoted to an account of garden plants in the many florists' varieties, which has caused his 'Paradisus terrestris' not only to be reprinted less than thirty years after its first publication, but also to attain the happy fate of being about to be reissued in facsimile within our own days. It owes this distinction to the taste for the varieties of the *Narcissus*, which Parkinson not only cultivated but also illustrated and described; and this modern taste caused the old copies to become so much sought after that

a London publisher has seen his way to prepare a reprint, reproduced by a photographic process. Eleven years later the same Parkinson brought out his 'Theatrum botanicum,' in which are given records for three Herts plants, *Specularia hybrida* from Hatfield, *Gentiana Amarella* at Gorhambury, and *Malaxis paludosa* between Hatfield and St. Albans, the last being the only record for a plant which has never been found again.

Next in order we have a man who may be termed a naturalist in spite of himself, the famous Izaak Walton; the plants he mentions as growing in the Lea valley are alluded to in Pryor's 'Flora' at p. xxxix. Incidentally one of the names he made use of has caused much discussion as to the plant itself intended, but I have very little doubt that "Culverkeys" refers to the wild hyacinth, *Scilla nutans*. Three years after the appearance of the first edition of the classic 'Compleat Angler,' William Coles, Herbarist, as he styles himself on the title-page of his larger book, brought out his 'Adam in Eden, or Natures Paradise.' In common with many contemporary authors, the volume displays an inordinately long statement of what it is and what it professes to set forth. I have brought the book to exhibit, and from it we have 25 records which have not been incorporated in our county annals. The book is further noteworthy for its most extraordinary pagination, of which no idea can be given save by appending a collation, and to make the story complete I give also the full title of the work—

'Adam in Eden: or Natures Paradise. The History of Plants, Fruits, Herbs, and Flowers. With Their several Names, whether Greek, Latin, or English; the places where they grow; their Descriptions and Kinds; their times of flourishing and decreasing; as also their several Signatures, Anatomical appropriations, and particular Physical Virtues; Together with necessary Observations on the seasons of Planting, and gathering of our English Simples: with Directions how to preserve them iu [*sic*] their Compositions or otherwise. A Work of such a Refined and Useful Method, that the Arts of Physick and Chirurgerie are so clearly laid open, that Apothecaries, Chirurgions, and all other ingenious Practioners, may from our own Fields and Gardens, best agreeing with our English Bodies, on emergent and sudden occasions, compleatly furnish themselves with cheap, easie, and wholsome Cures for any part of the Body that is ill-affected. For the Herbarists greater benefit, there is annexed a Latin and English Table of the several Names of Simples; With another more particular Table of the Diseases and their Cures treated of in this so necessary a Work.' By William

Coles, Herbarist. "Then the Lord took the Man, and put him into the Garden of Eden." Gen. 2. 25. London, Printed by J. Streater, for Nathaniel Brooke at the Angel in Cornhill, near the Royal Exchange, 1657.

Collation of the pagination—

Title-page and introductory matter, [20], 1–63, 65 (i.e. 64), 164–165, 116–126, 125–126, 129–132, 131–132, 135–161, 160–161, 65–83, 78, 75, 86–160, 111–112, 131, 164 [recto and verso], 164, 167, 166–206, 205–206, 209–264, 269–282, 238 (i.e. 283), 284–326, 237 (i.e. 327), 328–335, 335, 337–348, 347–348, 353, 350–396, 1–31, 23 (= 32), 33–66, 551–620, 620, 622, 627, 624–628, and 20 unnumbered pages.

From this it will be seen how extremely difficult it is to refer a reader to the right page; there are, for instance, no less than three pages numbered 125, and as many 161; many are wholly wanting; and then, after getting to page 396, the printer calmly goes back to 1, follows that to 66, and thence makes a leap to 551.

The author was born at Adderbury in Oxfordshire in 1626, and died in 1662, probably at Winchester: for some years he lived at Putney, and was engaged in work under the Bishop of Winchester. Anthony à Wood, in his 'Athenæ Oxonienses,' speaks of his attainments as a Herbarist in unstinted praise. There is a smaller volume of his which saw the light the year before the issue of the 'Adam in Eden,' namely, his 'Art of Simpling,' but I have not been able to examine it for this Address, the Banksian copy being reported "mislaid."

I now give the Hertfordshire stations and plants noted by Coles in 'Adam in Eden,' citing after the Latin name the English name employed by him; the pages must be used with care, as shown in the collation previously given. I have set against each entry the previous first record, which it will be seen varies in most cases.

Diplotaxis tenuifolia, DC. "The more common Wilde Rocket. Groweth very plentifully about the Abbey of St. Albans on every side, upon the Wals thereof, and divers other Wals thereabouts, that are of any standing, it being either the nature of the Mortar thereabouts to produce it, or else the seeds are carried upon them by the wind, or rather by Birds." P. 37 after 396.

Anticipates Coleman, 1843.

Malva moschata, Linn. "In the Fields also about St. Albans." P. 126 (i.e. 162).

Gerard is still the first record, 1597.

Ilex Aquifolium, Linn. "Prickly Holly. In the [county of] Hartford." P. 385.

Previous first record, Coleman, 1838.

Alchemilla vulgaris, Linn. "Lady's Mantle. In Pray Wood, near St. Albans." P. 118.

Recorded by Gerard, 1597.

Potentilla Tormentilla, Neck. "Tormentil. Great plentie of it is to be found in Pray Wood near St. Albans." P. 76.

Previous to Coleman, 1838.

Sorbus Aucuparia, Linn. "Quicken Tree. Amongst Trees in the walk between Shaford and Gorehambery." P. 305.

Previous to Coleman, 1845.

Saxifraga granulata, Linn. "White Saxifrage. Groweth very plentifully in a feild immediately below the Abby Orchard at St. Albans." P. 351.

Before Blackstone, 1737.

Sedum vulgare, Link. "Purple Flowered Orpine. About St. Albans." P. 129.

Before Coleman, 1838 ?

Sanicula europæa, Linn. "Sanicle. Likewise by St. Albans under a hedge, that groweth between the Trench that went about old Verulam, and the way to Windridge." P. 161 (2).

Before Coleman, 1838.

Sambucus Ebulus, Linn. "Wallwort, Danewort. In the Abby Orchard at St. Albans." P. 296.

Before Milne and Gordon, 1790.

Galium Mollugo, Linn. "Common white-flowered Ladies Bedstraw. In the Abbey Orchard, St. Albans." P. 628.

Previous first record, Rudge, 1820.

Dipsacus pilosus, Linn. "Shepherd's staff. By St. Albans, in the Horse-way that goeth from the Abbey Parish to St. Stevens." P. 23 (after 396).

Previous first record, J. Woods, 1805.

Inula Helenium, Linn. "Elecampane. It groweth plentifully in the fields on the left hand as you go from Dunstable to Puddle Hill." P. 148.

Before Coleman, 1838 ?

Lysimachia vulgaris, Linn. "Yellow willow herb, with double flowers. Groweth by King's Langley in Hertfordshire." P. 618.

How, in Phyt. Brit., was five years earlier.

Vinca major, Linn. "Periwinckle. The greater groweth on the north west side of St. Albans, under a hedge, encompassing a field sometimes in the occupation of Mr. Pollard." P. 131 (the second of three so numbered).

Previous to Milne & Gordon, 1793.

Fraxinus excelsior, Linn. "The Ash-Tree . . . . particularly amongst Trees in the walk between Shaford and Gorehambery." P. 305.

Anticipates Cook, 1676, and Coleman, 1838.

Gentiana Amarella, Linn. "Autumn Gentian with Centaury leaves. Also not far from St. Albans upon a peece of wast chalky ground, as you go out of Dunstable way towards Gorehamberry." P. 191.

Parkinson recorded this in 1640.

Veronica officinalis (?), Linn. "Common Speedwell. Particularly in Prey Wood by St. Albans very plentifully." P. "622."

Previous first record, Coleman, 1838.

Digitalis purpurea, Linn. "Foxglove. About St. Albans." P. 127.

Previous first record, Coleman, 1838.

Galeobdolon luteum, Huds. "Yellow Archangel. Under a hedge on the further side of a Meadow by St. Albans, near the Causey that leadeth from thence, to Mr. Cottons House, on the left hand, a little before you come to the turning of the way, up to Windridge, where I shewed [it] to my worthy Friends, Dr. Arris, a Doctor of Physick, and Mr. Dichfield, School-master of St. Albans." P. 125.

Gerard recorded this in 1597.

Origanum vulgaris, Linn. "Wilde Marjerome. On both sides the Foot-way which leadeth from St. Albans to Mr. Cottons house, near unto the place where old Verulam stood." P. 21.

Anticipates Hill, 1775.

Polygonum Bistorta, Linn. "Bistort. In a Meadow about a stones throw above the Abby Mill at St. Albans, about an Acres breadth, or somewhat more from the River side, where the common Bistort groweth plentifully, though it be chiefly nourished in Gardens." P. 74.

Precedes Blackstone, 1737.

Daphne Laureola, Linn. "Spurge Laurell. Between the Hedge and a foot-path that leadeth from St. Albans to Park Street." P. 311.

Before Sabine, 1815.

Asplenium Trichomanes, Linn. "English Maidenhair. Upon a wall near to Goreham berry, in Hartfordshire." P. 33.

Previous first record, Coleman, 1838.

Osmunda regalis, Linn. "Osmunda. By a hedge-side in a medow on the left hand of the way that goes from St. Albans to Windridge." P. "324."

First and only record; not given in Pryor's 'Flora.'

We have to thank Mr. G. Claridge Druce, F.L.S., for calling attention to these records in the pages of the 'Midland Naturalist,' xvi (1893), pp. 17–18.

[Since the foregoing was delivered, I have been able to refer to another copy of the 'Art of Simpling.' The work does not contain any localities, but is simply an introduction to botany as understood in Coles's days. Its full title runs thus:—

'The Art of Simpling. An Introduction to the Knowledge and Gathering of Plants. Wherein the Definitions, Divisions, Places, Descriptions, Differences, Names, Vertues, Times of flourishing, and gathering, Uses, Temperatures, Signatures, and Appropriations of Plants are methodically laid down. Whereto is added, A Discovery of the lesser world.' By W. Coles. London. Printed for Nath: Brook at the Angell in Cornhill. 1656. 12mo. pp. (16) 123.

The curious pagination noted in 'Adam in Eden' is found here in a lesser degree. The paging goes on regularly as far as page 96, then with signature F the drollery begins, each leaf having a different page on its *verso* from expectation, as shown in the following pairs of pages, *recto* and *verso*:—73, 98; 99, 76; 77, 102; 103, 80; 81, 106; 107, 84; 85, 110; 111, 88; 89, 114; 115, 92; 93, 118; 119, 96. Sig. G is correct, pp. 121–123.]

In his second book, the first issued under his name and not anonymously, his 'Catalogus plantarum Angliæ,' 1670, John Ray mentions *Orchis ustulata* on Royston Heath; in other publications, as recorded in the 'Flora,' he adduced four other plants from his own observations. But there are also secondary records in his books, for a correspondent of his, Dr. Eales, living at Welwyn, records five other plants for the first time from Hertfordshire. I am sorry not to be able to tell you anything about Dr. Eales, for beyond the fact of his communicating plants to Ray, nothing seems known about him. His plants were *Linaria decumbens*, *Mentha piperita*, *Cephalanthera pallens*, *C. ensifolia*, and *Listera ovata*.

I have now to introduce to some of you a new name to county botany, that of Moses Cook, gardener to the 1st Earl of Essex, Lord Lieutenant of the County, at Cassiobury. The book in question,—'The Manner of Raising, Ordering, and Improving Forest-Trees; with Directions how to Plant, Make, and Keep Woods, Walks, Avenues, Lawns, Hedges, etc. . . .' London, 1676, revised in 1679, a second edition in 1717, and a third edition in 1724,—shows that the writer was a very capable man, and well versed in his work. Thus, he recommends that newly-planted trees should receive a covering of stable manure over their roots, and he scouts the advice given by Lord Verulam that stones should

be so placed; his was the advice of a practical man as opposed to that of a philosopher. His competence may also be gauged by his account of the transport of lime-trees from Hadham, where they had been raised, to Cassiobury, and there planted in an avenue in 1672: of 296, not one tree died as the result of removal, whilst of 30 trees from the same parcel, equally good and strong, sent to Sir William Temple and planted at Sheen in better soil by other hands, four-fifths died. Cook's success must be ascribed to his preparation of the stations for planting, and care in the operation. (Ed. 1, pp. 21, 22; ed. 3, p. 32.)

He also speaks of the converse operation, removing a hedge of juniper from Cassiobury to Hadham, thus: "I confess it is something ticklish to be remov'd: for it's being not used to stir far from home, makes it many times lose its way, and its Life too, if led too far from its native place at unseasonable times, or by an ignorant Guide, and put into such an Habitation as is not suitable for it to live in. I have with good success remov'd it above thirty miles, namely, from beyond Cashioberry to Little Hadham; there I made my Ground (notwithstanding it was naturally a stiff clay) by mixing it well with Gravel and Sand. I remov'd it a little after Bartholomew-Tide, and I did not lose one Plant in ten; but they do flourish in two little hedges most gallantly." (Ed. 1, p. 96; ed. 2, p. 164.)

There is in some cases a doubt as to whether the trees he mentions are really wild specimens, or planted, but such as they may be are set out here, as being the earliest records of three or four ligneous plants of our county.

Still quoting from the first edition of 1676, we have as presumed native plants (1) *Prunus avium*, "Woods at Cashiobury and hedges about," p. 65, thus anticipating Sabine, 1815; (2) the Ash, *Fraxinus excelsior*, " . . . in the Wood-walks at Cashiobury . . . to Hemstead High-way," p. 120; " . . . at Hadham Hall," p. 55, before Coleman, 1838; (3) *Populus nigra* ? "Water-popler . . . I suppose this is the same which some call the Black popler: it growes in several places about Ware by the Ditch sides," p. 81; (4) a tree which is probably *Salix pentandra*, "Smelling willow . . . it shoots a great shoot, bears fine broad shining Leaves . . . It bears a sweet beautiful Flower . . . From one small Plant I have Raised some hundreds, and have set several in our Wood-walks at Cashiobury where they grow well . . . ," p. 82; lastly (5), the Birch, probably *Betula verrucosa*, "About Cashiobury in several woods," p. 76.

I cannot, however, take leave of this worthy man without

making one other quotation from his pages. Previously I gave you an extract from Viscount St. Albans, noted before I had come upon Cook's commentary on the same passage; let me give you the latter, as once again the statement of the practical man delivered against that of the philosopher.

"The Lord Bacon, in his natural History, tells you of an old Tradition, that Boughs of an Oak put into the Earth will put forth wild Vines. I wish all such old Traditions were bury'd in the Earth in the room of the Oak-Boughs.

"He tells us also of an old Beech-tree cut down, the Root whereof put forth a Birch. See p. 111 [132].

"This most learned Man, in his next page lays down six Rules (tho all, as he confesseth, untry'd by him) concerning the Transmutation of Plants.

"The First is, If you would have one Plant turn into another, you must have the Nourishment overrule the Seed.

"The Second is, To bury some few Seeds of the Plant you would change among other Seeds.

"The Third is, To make some medley or mixture of Earth with some other Plants bruised or shaven, either Leaf or Root.

"The Fourth is, To mark what Hearbes some Earth does put forth of itself, and to sow some contrary Seed in that Earth.

"The Fifth is, To make an Herb grow contrary to its Nature.

"The Sixth is, To make Plants grow out of the Sun, or open Air: as the bottom of a Pond, or in some great hollow Tree.

"I might and could answer to all these, but I think it would be too tedious: for I verily believe, that to sow Seeds any way that can be devised by Man will not in the least cause them to be quite another kind of Plant, that is, . . . there is no real Alteration but by Seed."

If we add to this last sentence, the known origin of sports by bud-variation, Moses Cook is shrewdly near the mark. John Evelyn had a high regard for Cook, and in return Cook frequently cites "Squire Evelyn."

I have to thank Mr. John Hopkinson for calling my attention to this most interesting local work, and I believe I am correct in further stating that it was our past President, Mr. Lewis Evans, who first drew Mr. Hopkinson's notice to the book in question.

It was about the close of the seventeenth century that two other of Ray's correspondents contributed to the county records. The first, Leonard Plukenet, was responsible for *Campanula rotundifolia*: he lived for some years on a farm he possessed at Horn Hill, near Chalfont St. Peter, just within our county boundary ('Trans. Watford

Nat. Hist. Soc ,' vol. i, 1875, p. 23), and did not neglect native plants, though his attention was concentrated upon exotics, on which he published at some length, and his collections are to be seen in sundry volumes of the Sloane Herbarium at the Natural History Museum, Cromwell Road. The other, Samuel Doody, commemorated in the fern genus *Doodia*, is connected with Herts by his record of five species—*Medicago falcata*, between Watford and Bushey Mill; *Heracleum Sphondylium*, at Tring; *Euphorbia platyphylla*, at Otterspool; *Neottia Nidus-avis* and *Herminium Monorchis*, both at Tring. He published nothing himself, but was in close connection with the leading botanists of his day, and noted his finds in an interleaved copy of Ray's 'Synopsis' now in the British Museum at Bloomsbury.

A gap of something like thirty years separates the next on our roll from those who preceded him, and he is the last of the pre-Linnean botanists. John Blackstone resided for four months at Harefield at the house of some friends, detained there by illness, and he amused himself by compiling a small book which I have here to exhibit to-night, entitled 'Fasciculus plantarum circa Harefield sponte nascentium . . . ' Londini, 1737. Being so close to the county boundary it possesses great interest for Hertfordshire naturalists, and is frequently quoted by Mr. A. R. Pryor in his 'Flora.' Nine years later the same writer produced his 'Specimen botanicum,' 1746, which was not confined to a small radius, but embraced the whole of the southern and midland counties. This volume is also on the table for your inspection; it was the last published in the Raian period, before the Linnean system gained the mastery over its predecessors.

Within eighteen months from the date of the preface to this modest little volume, one of Linnæus's pupils visited the county, and I have given in our 'Transactions,' Vol. IX, Part 4, July, 1897, an account of the circumstances under which Pehr Kalm made his visit. On pp. 121–125 I have set out a list of his observations of the native plants within our area, and therefore need not dwell further on this point. Indeed, though the field is large and many more names offer temptation to continue in this vein of reminiscence, I dare not trespass more than a few minutes longer on your forbearance.

Kalm was the forerunner in this country of his instructor's system, which made its first appearance in the shape of an adaptation by Dr. John Hill of Ray's 'Synopsis,' followed in 1762 by a work of genuine value, William Hudson's 'Flora Anglica.' Though this author was, to use an old phrase, "a diligent searcher

of simples," the only addition he made to the county record was that of *Libanotis montana*. His contemporary, William Curtis, noticed *Trifolium ochroleucum*; he is well known for his splendid 'Flora Londinensis,' and also as the founder of the 'Botanical Magazine,' a serial still vigorously carried on under the editorship of Sir Joseph Hooker.

Many other botanists are noted in Pryor's 'Flora,' but the list is too long to engage our attention. From the end of the eighteenth century we soon come to the first flora of Hertfordshire, and the names of William Higgins Coleman and of Robert Holden Webb will ever be held in high honour by local observers. From them we soon arrive at men of our own time, and can recall excursions made in the company of many who have since passed away; the recollection of those pleasant rambles in byegone days remaining with us as a delightful possession. When the time arrives for our work to be impartially judged, may it prove worthy to be ranked with that of our predecessors.

XIII.

REPORT ON PHENOLOGICAL PHENOMENA OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1903.

By Edward Mawley, Past-Pres. R. Met. Soc., F.R.H.S.

Read at Watford, 19th April, 1904.

It is to be regretted that the neighbourhood of Buntingford remains altogether unrepresented, and that for the first time for many years there is no observer of either plants or insects at St. Albans.

The following table gives the list of observers, the districts they represent, and the approximate height of the stations above sea-level. Three of the stations are just outside our County boundary, Harefield being in Middlesex, Chesham in Bucks, and Odsey in Cambridgeshire. The sequence is from south to north.

Station.	Height above Sea-level.	Observer.
Harefield (The Scrubbs)	340 feet.	G. E. Eland.
Watford (The Platts)	240 ,,	Mrs. G. E. Bishop.
Watford (Weetwood)	270 ,,	Mrs. J. Hopkinson.
Chesham (Cannon Mill Cottage)	300 ,,	Miss G. Keating.
Broxbourne	120 ,,	Rev. H. P. Waller.
St. Albans (Worley Road)	300 ,,	H. Lewis.
Berkhamsted (Rosebank)	400 ,,	Mrs. E. Mawley.
Hatfield (Symonds Hyde)	300 ,,	T. Brown.
Hertford	140 ,,	W. Graveson.
Sawbridgeworth	240 ,,	H. S. Rivers.
Harpenden (Hecla Villa)	370 ,,	J. J. Willis.
Hitchin	230 ,,	A. W. Dawson, M.A.
Odsey, Ashwell	260 ,,	H. G. Fordham.

The Winter of 1902–3.

This proved a singularly mild Winter. In fact, with the exception of ten days at the beginning of December and a week in the middle of January, when low temperatures prevailed, the weather continued throughout unusually warm. On no night did the exposed thermometer at Berkhamsted show more than 19 degrees of frost, whereas it is very seldom that an entire Winter is passed through without a lower temperature than this being at some time registered. It was not only a very warm but also a very dry Winter, while the duration of sunshine was about seasonable.

At the beginning of the season the usual work on the farm at that time of year was in an exceptionally forward state. This was in a great measure owing to the dry and satisfactory condition of the land during the greater part of the previous Autumn. Not only had a larger area than usual by that time been planted with wheat and other winter crops under the most favourable circumstances, but most of the ground destined for spring corn was

ploughed before Christmas. Moreover, those farmers who took advantage of the fine weather in February were able to sow their beans and peas and also their spring corn under specially favourable conditions and when the ground was in an excellent state to receive them. The mild weather also favoured the pastures, which during a great part of the Winter remained fresh and green; and as the yield of hay, turnips, and mangolds in the previous year had been abundant, there was never any lack of fodder for the sheep and cattle.

This was an equally propitious season for cultivating the soil in the garden, while the mild weather allowed the winter supply of green vegetables, which has seldom been so good, to remain uninjured by frost. In the flower-garden there were fewer flowers to be seen in the early part of the Winter than has been the case in recent years, but this is accounted for by the spell of cold weather which set in rather suddenly at the beginning of December. This brief touch of frost was, however, welcome, as it gave a much needed check to the growth of fruit-trees, roses, and other hard-wooded plants.

At Berkhamsted the winter aconite first showed an open blossom on January 5th, which is sixteen days earlier than its average date in the previous fourteen years and earlier than in any of those years. A day later the same plant was noted as first in flower at Watford.

The first fertile flowers appeared on the hazel five days later than their average date in the previous twenty-seven years. The song-thrush was first heard after the beginning of the year twelve days in advance of its mean date, while the honey-bee was first seen to visit flowers nine days behind its usual time.

The Spring.

Taken as a whole, this was a rather warm, exceptionally wet, and very dull quarter. It is, however, necessary to examine it a little more closely in order to form something like an accurate estimate of its true character. For instance, March proved remarkably warm throughout and at the same time singularly wet, with rather more than the usual amount of sunshine. April, on the other hand, was exceptionally cold, with cloudy skies, and an average rainfall. In May the temperature and rainfall were both about seasonable, while the record of sunshine proved very scanty.

The weather in March was so extremely wet that it was only during the drier intervals in the middle of the month that any sowing was possible. After the first week in April, however, the condition of the land improved, and during the next fortnight a good deal of spring corn was got in. In the second half of May the land was again in fairly good tilth, which gave an opportunity for the arrears of corn, clover, and mangold sowing to be made up, and for the planting of potatoes and the preparation of the ground for turnips and swedes to be taken in hand. It is seldom that the spring sowing-time extends over so long a period as it did in 1903,

so frequent were the interruptions through wet weather. Notwithstanding the many adverse conditions of the season, the appearance of the crops at its close was, as a rule, satisfactory, and more particularly that portion of the corn which had been sown in the Autumn and during the favourable weather in February.

The prospects for the hay were greatly improved by the heavy rains at the end of April and beginning of May, and by the ten days of genial weather at the close of the latter month. In the same way the pastures were also benefited.

The sowing period in the garden was likewise unsatisfactory, owing to the changeable character of the weather, and the cold and saturated state of the soil throughout the greater part of it. The fruit-blossom suffered greatly during the cold spell in April. In fact, in most places nearly the whole of the abundant bloom was destroyed by the persistent frosts and cold winds. A few particulars respecting the weather prevailing at that time may therefore be of interest. On each of the fourteen nights the cold spell in question lasted the exposed thermometer at Berkhamsted registered 3 or more degrees of frost, and on five consecutive nights from 10 to 13 degrees of frost. The great damage done to the fruit-blossom by these April frosts was no doubt due to the fact that at the time they occurred vegetation generally was in an exceptionally forward condition, and that the cold spell was immediately preceded by a long term of warm and wet weather. On the other hand, both the ground and the atmosphere were unusually dry when the keenest frosts took place, or the injuries done to plants, other than fruit-trees, might have been much more serious than they were.

Mrs. Bishop, writing from Watford on April 8th, mentions the magnificent show of blossom at that time on the cherry-trees. This was, of course, before the April frosts. To show the severity of these frosts, our observer at Hatfield states that "a number of plants, amongst them the elder, hawthorn, dog's mercury, and the common nettle, had their foliage blackened by them." Mr. Willis mentions the scanty blossom on the apple-trees, blackthorns, and plums at Harpenden.

It will be noticed that the records for the spring-flowering plants on the list are for some reason irregular. The coltsfoot was one day early, the wood-anemone one day late, the blackthorn eleven days early, the garlic hedge-mustard thirteen days early, the horse-chestnut seven days late, the hawthorn five days early, and the white ox-eye six days late.

As had been the case in the four previous years, the spring migrants arrived behind their average dates. The swallow was eleven days late, the cuckoo thirteen days late, the nightingale fourteen days late, and the flycatcher four days late.

The wasp made its appearance five days late, the small white butterfly eleven days late, and the orange-tip butterfly fifteen days late.

TABLE I.—DATES OF FLOWERING OF PLANTS OBSERVED IN 1903, WITH THE MEAN DATE FOR 1876–1902.

SPECIES.	HAREFIELD.	WATFORD.		CHESHAM.	BROXBOURNE.	BERKHAMSTED.	HATFIELD.	HERTFORD.	SAWBRIDGEWORTH.	HARPENDEN.	HITCHIN.	ODSEY (Ashwell)	MEAN.
		THE PLATTS.	WEETWOOD.										
Hazel (*Corylus avellana*)	.....	Feb. 3	Feb. 5	.....	Feb. 3	Feb. 14	Jan. 21	Feb. 1	Feb. 5	Feb. 7	.....	Jan. 26	Jan. 29
Coltsfoot (*Tussilago farfara*)	.....	.....	Mar. 10	Mar. 19	Feb. 25	Feb. 18	.....	Feb. 22	Mar. 20	Feb. 19	.....	Feb. 8	Mar. 1
Wood-Anemone (*Anemone nemorosa*)	Apl. 5	Apl. 7	Mar. 19	.....	Mar. 15	Mar. 25	Mar. 21	Mar. 8	Mar. 23	Mar. 30	.....	.....	Mar. 23
Blackthorn (*Prunus spinosa*)	Mar. 28	Apl. 4	Mar. 29	.....	Mar. 30	Mar. 29	Mar. 22	Mar. 2	Mar. 22	Mar. 22	.....	.....	Apl. 4
Garlic Hedge-Mustard (*Alliaria officinalis*)	.....	Apl. 6	Apl. 1	Apl. 3	Apl. 5	Apl. 15	.....	Apl. 5	Apl. 8	Apl. 9	.....	.....	Apl. 20
Horse-Chestnut (*Æsculus hippocastanum*)	May 19	.....	May 17	May 22	.....	May 21	May 9	May 6	.....	May 19	.....	.....	May 9
Hawthorn (*Cratægus oxyacantha*)	May 14	.....	May 3	May 12	.....	May 23	May 2	Apl. 29	.....	May 20	May 2	Apl. 27	May 13
White Ox-Eye (*Leucanthemum vulgare*)	May 30	.....	May 26	May 13	.....	May 25	May 29	May 28	.....	June 1	.....	.....	May 20
Dog-Rose (*Rosa canina*)	June 7	.....	June 2	.....	May 30	June 6	June 3	June 3	.....	June 5	June 1	June 3	June 6
Black Knapweed (*Centaurea nigra*)	.....	.....	July 7	July 26	.....	.....	July 26	June 28	.....	.....	.....	.....	June 25
Harebell (*Campanula rotundifolia*)	.....	.....	.....	.....	.....	July 18	.....	July 16	.....	.....	July 22	.....	July 5
Greater Bindweed (*Convolvulus sepium*)	July 25	.....	.....	July 15	.....	July 13	July 19	July 26	.....	.....	.....	.....	July 9
Ivy (*Hedera helix*)	.....	.....	Sept. 21	Oct. 28	Sept. 19	Oct. 10	.....	Oct. 4	.....	.....	Sept. 25	Sept. 28	Sept. 27

TABLE II.—EARLIEST DATES OF OBSERVATION OF BIRDS AND INSECTS IN 1903, WITH THE MEAN DATE FOR 1876–1902.

SPECIES.	HARE-FIELD.	WATFORD.		CHES-HAM.	BROX-BOURNE.	ST. ALBANS (Worley Road).	BERK-HAMSTED.	HAT-FIELD.	SAW-BRIDGE-WORTH.	HAR-PENDEN.	HITCHIN.	ODSEY (Ashwell)	MEAN.
		THE PLATTS.	WEET-WOOD.										
BIRDS.													
Song-Thrush (*Turdus musicus*)	.....	Jan. 2	.....	.....	Jan. 4	.....	Jan. 7	Jan. 6	Jan. 2	.....	Jan. 6	.....	Jan. 17
Swallow (*Hirundo rustica*)	Apl. 26	Apl. 27	Apl. 27	Apl. 19	Apl. 16	Apl. 17	Apl. 20	Apl. 27	Apl. 10	Apl. 27	Apl. 30	Apl. 25	Apl. 12
Cuckoo (*Cuculus canorus*)	Apl. 27	Apl. 28	Apl. 26	Apl. 28	Apl. 28	Apl. 20	Apl. 20	Apl. 21	Apl. 25	Apl. 26	Apl. 30	Apl. 29	Apl. 13
Nightingale (*Daulias luscinia*)	Apl. 28	Apl. 27	.....	May 4	.....	.....	Apl. 29	Apl. 22	Apl. 30	Apl. 28	Apl. 25	May 7	Apl. 15
Spotted Flycatcher (*Muscicapa grisola*)	.....	.....	.....	.....	June 2	.....	.....	May 23	May 5	.....	.....	May 10	May 14 (10 years)
Swallow (last seen) (*Hirundo rustica*)	Oct. 17	Sept. 6	Oct. 12	Oct. 27	Oct. 29	.....	Oct. 10	.....	Oct. 30	.....	.....	Oct. 22	Oct. 17 (12 years)
INSECTS.													
Honey-Bee (*Apis mellifica*)	.....	.....	Feb. 11	.....	Feb. 8	.....	Feb. 11	.....	Feb. 9	.....	.....	.....	Feb. 1
Wasp (*Vespa vulgaris*)	.....	May 27	Apl. 26	Apl. 25	Feb. 20	.....	Apl. 12	.....	.....	Mar. 21	.....	.....	Apl. 7
Small White Butterfly (*Pieris rapæ*)	.....	.....	Apl. 12	Apl. 25	May 5	.....	Apl. 10	.....	.....	Mar. 30	.....	.....	Apl. 5
Orange-Tip Butterfly (*Anthocaris cardamines*)	.....	.....	.....	May 18	.....	.....	May 25	.....	May 21	May 28	.....	.....	May 8
Meadow-Brown Butterfly (*Epinephile janira*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	May 22

The Summer.

An exceptionally cold, wet, and sunless season. Of the months composing it June was the coldest and wettest, and July the least unseasonably cold and rainy of the three. Although the temperature was, as a rule, low, and the rainfall excessive, there occurred during the course of this Summer a warm, dry, and sunny period, lasting very nearly a month.

Seldom is the hay-crop so favoured by the weather as it was in 1903. First came the wet period at the end of April and beginning of May, and when the ground was completely saturated this was followed by ten warm days at the close of the latter month, which caused the grass to start rapidly into growth. Finally, the drenching rains in the middle of June were fortunately succeeded by a month of warm and dry weather, which enabled the bulk of this crop to be gathered in with little trouble and in excellent condition. This warm and dry period, the only genial weather of the Summer, also helped forward all the other farm-crops. And yet before it came to an end rain was becoming much wanted for the late-sown corn and also for the roots, which had had no opportunity of obtaining a firm root-hold of the ground. The fact is, the heavy June rains had so beaten down the soil that it had become caked and hard on the surface, and was therefore little able to resist anything like continued dry weather. The harvest was late and began under very unfavourable circumstances, owing to the continued rains which again set in at the end of July, and which lasted with but little interruption until the end of the Summer.

In the gardens everything remained very backward until the warm and dry period, before mentioned, set in about Midsummer Day, when considerable advance was made. This was the one drought of the year, and a very remarkable drought it was, as it occurred in the middle of an exceptionally wet Summer and continued for twenty-six days. For fifteen days no rain fell at Berkhamsted, and during the twenty-six days the drought lasted less than a quarter of a gallon of rain was deposited on each square yard of surface in my garden. Over the greater part of the county the drought was still more prolonged, no rain falling at most of our rainfall-stations for at least twenty-two days.

Mr. Willis gives June 21st as the date when the first ear of wheat was observed out of the sheath, which is later than in any of the previous eleven years. He further states that the harvest at Harpenden was not general until the third week in August. Our observer at Harefield gives June 22nd for the commencement of the hay-harvest and August 9th as the date when the first wheat was cut.

The plants on the list which flower during the summer months were, as a rule, late in coming into blossom. The dog-rose was three days early, the black knapweed nineteen days late, the harebell fourteen days late, and the greater bindweed eleven days late.

The Autumn.

September and November were of about average temperature and rainfall, while October proved very warm and persistently wet. There was a fair record of bright sunshine in September and November, whereas October proved an unusually gloomy month.

Harvest began in August, but little progress was made during that month owing to frequent interruptions by rain. The first three weeks in September were, however, more favourable, and it was during that period that the greater part of the corn-crop was got in. Then came a return to rainy conditions, which lasted throughout the whole of October with virtually no intervals of fine weather at all. During that month the corn which still remained in the fields became much discoloured by the incessant rainfall, and in some cases the grain sprouted. With the advent of November a change to fine dry weather took place, and the remaining sheaves were soon harvested, an exceptionally prolonged and expensive harvest being at last brought to an end. Here and there, however, was to be seen even as late as December the unusual sight of shocks of corn still standing in the fields. The root-crops improved greatly in September and November, but made very little progress during the wet and dreary weather of October. Potatoes suffered greatly from the continued rain, and became much diseased and in many cases were not worth lifting. Throughout the season there was always, except of course in the low-lying lands which were flooded, plenty of herbage for the cattle in the pastures. During October the prospect all round appeared hopeless, but the situation was saved, at all events so far as it was then possible, by the continued fine weather in November, for the remains of harvest-work could then be cleared off, and mangolds and potatoes taken up. It also enabled the farmers to plough and clean the land, and to complete the sowing of winter corn under favourable conditions.

By the horticulturist this change, late though it came, was also warmly welcomed, for it enabled all late-flowering plants to continue freely in bloom until their progress was finally arrested by frost. The winter supply of vegetables also improved. The fruit-trees, after a long succession of dry Summers, were greatly benefited by the abundant supply of water in the subsoil throughout the season. The only crop which the weather of the year entirely suited, both on farm and in garden, was the crop of weeds. The moisture in the subsoil also favoured the forest trees, which have not for some years been so luxuriant in foliage, or made such vigorous growth as the majority of them did in 1903. Blackberries were plentiful, but late in ripening; most other wild fruits, however, were unusually scarce. Butterflies, wasps, and insects generally were not nearly so numerous as usual.

According to the returns of farm-produce published by the Board of Agriculture for Hertfordshire, the yield of wheat was 7 per cent. below the average for the previous ten years, of barley

2 per cent. below, of potatoes 31 per cent. below, and of mangolds 2 per cent. below the ten years' average. On the other hand, beans were 5 per cent. above, peas 1 per cent. above, and turnips 1 per cent. above their respective averages for the same ten years; hay (from permanent pastures) was 9 per cent. above the average, and hay (from clover, etc.) 22 per cent. above it; while oats come out as an average crop.

The fruit-crops, according to the returns sent in to the 'Gardeners' Chronicle,' were, taking the county as a whole, all much under average, except strawberries, which yielded well.

Mrs. Bishop, writing from The Platts, Watford, on Sept. 21st, states that the filberts had yielded the only good crop of fruit in her orchard. Mr. Willis refers to the potato disease as being very prevalent, and states that much of the crop still remained in the ground in January, 1904, not being considered worth lifting.

The last plant on the list, the ivy, was five days late in coming into flower.

The swallow took its departure two days earlier than its mean date for the previous twelve years.

XIV.

REPORT ON THE RAINFALL IN HERTFORDSHIRE IN THE YEAR 1903.

By John Hopkinson, F.L.S., F.G.S., V.P. R. Met. Soc., Assoc. Inst. C. E.

Read at Watford, 29th March, 1904.

The staff of our observers for the year 1903 shows an increase of four on the number for the previous year, the losses being two and the gains six. The stations discontinued are Offside Cottage, Cowroast, owing to the death of the observer; and Desmond Cottage, Bennington, where the observer, who has since died, transferred her rain-gauge to her nearest neighbour owing to ill-health. The additions are Fairhill, Berkhamsted, a former station reinstated; the Colne Valley Water Works, Watford, also a former station; Valency House, Eastbury, Watford; Easby, Northwood; Eileen Cottage, Bennington; and the Manor House, Knebworth. Fairhill, Berkhamsted, takes the place of Offside Cottage, Cowroast, making no difference in the number of rainfall stations in the river-district of the Bulbourne; the Lower Colne district gains three stations, all in the neighbourhood of Watford; and Knebworth adds one to the stations in the district of the Beane, in which, at Bennington, Eileen Cottage takes the place of Desmond Cottage, the gauge formerly used there having, in fact, been moved a short distance only.

Owing to these alterations the principal table contains the records of 52 stations, being four more than in any previous year. The number of daily records received is 45, which is five more than in any previous year. The year is therefore a record one, both in the total number of returns and in the fulness of detail supplied by the large number of daily returns.

Particulars of the 52 rainfall stations, and the monthly and total rainfall and number of days of rain in 1903, are given in Tables I and II, pp. 99–101.

A supplementary table (Table III, p. 102) gives twelve other records of the total rainfall in the year. Two are records of additional gauges at Rothamsted, four are those of additional gauges at Odsey, Rosebank and Rose Cottage, Berkhamsted, and at Weetwood, Watford, one was received too late for insertion in the principal table, and five are from 'British Rainfall, 1903.'

The mean rainfall in Hertfordshire in the year 1903 was 37·83 inches. This is 13·05 inches above the average for the decade 1890–99, and 11·68 inches above that for the 60 years 1840–99. The mean number of wet days in the year was 188, being 21 more than the average for the thirty years 1870–99, and 26 more than that for the previous year. Last year was therefore one of excessive rainfall of frequent occurrence. It was, in fact, much the wettest year in our county since 1852, but our records for that

year are too few to enable us to judge which of the two years had the highest average over the county. The following comparison may, however, be of interest:—

	1852.	1903.
Royston*	33·06	34·42
Hitchin (Wratten)	34·11	37·56
Tring (Cowroast)	39·40	42·33
Hemel Hempstead†	41·14	40·24
Harpenden (Rothamsted) ...	37·82	37·35
Hoddesdon (Feilde's Weir) ...	39·71	36·34
Mean	37·54	38·04

The only certain deduction which can be made from this comparison is that 1903 was the wettest in the north and west of Hertfordshire, and 1852 in the centre and south-east.

Judging from the records of other stations in the Home Counties, it is possible that 1834 may have been a wetter year in Hertfordshire than either 1852 or 1903, Sandhurst, Berks, having recorded 33·6 ins. in 1834 and 35·6 in 1852; and Greenwich, Kent, 36·3 ins. in 1834 and 34·4 in 1852. At any rate, we may confidently include 1834 with 1852 and 1903 as the wettest years in our county from the commencement of the nineteenth century at least.

Droughts in 1903.—It is remarkable that in this very wet year, the wettest season of which was the Summer, there should have been, in the Summer, an unusually long "absolute" drought recorded at all our stations,—a period without a measurable quantity of rain, of an average duration, taking one station with another, of over three weeks. It lasted for 15 days, June 20 to July 4, at seven stations; for 20 days, June 21 to July 10, at one station; for 21 days, June 20 to July 10, at six stations; for 22 days, June 20 to July 11, at nine; for 23 days, June 21 to July 13, at three; for 24 days, June 20 to July 13, at twelve; for 26 days, June 20 to July 15, at five; and for 27 days, June 20 to July 16, at two stations. Nine stations record an earlier "absolute" drought of 21 days at each, from May 18 to June 7. There was no "partial" drought.‡

Distribution of the Rainfall throughout the Year.—Of the total rainfall of 37·83 inches, 17·19 fell during the six winter months and 20·66 during the six summer months. During the first quarter of the year 6·57 ins. fell, during the second 10·13 ins., during the third 10·53 ins., and during the fourth 10·60 ins. For three quarters of the year these quantities are remarkably close. During the Winter of 1902–3 (Dec. to Feb.) 4·75 ins. fell, during the Spring (March to May) 7·46, during the Summer (June to August) 13·89, and during the Autumn (Sept. to Nov.) 11·03.

* London Road, 1852; Melbourne Street, 1903.

† Nash Mills, 1852; Apsley Mills, 1903.

‡ Definitions of "absolute" and "partial" droughts have been given in previous reports.

Table I.—Hertfordshire Rainfall Stations, 1903.

District.	Station.	Observer or Authority.	Diameter of Gauge.	Height of Gauge above Ground.		Height of Gauge above Sea-level.	
			ins.	ft.	ins.	ft.	+
1.	Royston—Melbourne Street	Joseph E. J. Phillips	8	0	11	201	T
,,	*Odsey	H. George Fordham	5	1	0	256	⅄
2.	*Baldock—High Street	F. W. Langston Day	5	1	0	214	⅄
3.	*Preston—The Laburnums	R. de V. Pryor	8	2	6	480	⅄
,,	Hitchin—Wratten	William Lucas	5	2	1	238	⅄
,,	,, The Maples	William Hill	8	1	1	220	T
,,	* ,, The Chilterns	Francis Ransom	5	0	9	300	⅄
,,	* ,, High Down	Joseph Pollard	5	1	1	422	⅄
4.	Tring—Pendley Manor	J. G. Williams	5	2	0	420	
,,	,, Bulbourne	Gordon C. Thomas	5	2	3	401	
6.	Wigginton Vicarage	Rev. H. J. E. Burrell	5	1	0	710	⅄
,,	Cowroast	Gordon C. Thomas	5	3	8	394	⅄
,,	*Berkhamsted—Fairhill	Miss M. Hopkins	5	1	0	548	⅄
,,	* ,, Rosebank	Edward Mawley	8	1	0	401	⅄
,,	* ,, Rose Cottage	W. E. Milner	5	1	0	334	⅄
7.	*Great Gaddesden Vicarage	Rev. W. T. T. Drake	8	1	0	427	⅄
,,	*H. Hempstead—Apsley Mills	J. Dickinson & Co.	24	0	9	260	
8.	*Kensworth—The Grove	Miss S. Grace Jones	5	1	5	630	B
,,	*Harpenden—Rothamsted	A. D. Hall	5	0	9	420	T
,,	*St. Albans—Gorhambury	W. Newberry	5	1	0	423	T
,,	* ,, Herts County Museum	John Hopkinson	5	1	0	389	T
,,	* ,, Bone Hill	H. J. T. Broadwood	5	1	0	336	⅄
,,	*Frogmore—The Cottage	A. B. Lipscomb	5	0	10	218	
9.	*Elstree—Aldenham House	Edwin Beckett	10 sqr.	4	9	305	
10.	*Watford—Weetwood	John Hopkinson	5	1	0	269	⅄
,,	* ,, Lond. Orph. Asylum	Dr. O. C. Cockrem	5	1	0	231	T
,,	* ,, Frogmore	Arthur P. Blathwayt	5	1	0	182	T
,,	*Colne Valley Water Works	W. Verini	5	1	2	220	
,,	*Rickmansworth—Moor Park	Lord Ebury	5	2	0	340	⅄
,,	*Eastbury—Valeney House	H. Langford Lewis	5	1	0	360	T
,,	*Northwood—Easby	Mrs. S. Fawcett	8	0	10	400	T
12.	*Welwyn—Danesbury	Col. A. M. Blake, C.B.	8	1	0	400	
,,	* ,, Bridge House	B. Wilfred Thomas	5	2	3	216	
,,	*Datchworth Rectory	Rev. Andrew Amos	5	1	0	372	⅄
13.	*Weston—Weston Park	M. R. Pryor	5	0	8	470	T
,,	*Bennington—Eileen Cottage	A. B. Legard	5	1	0	408	
,,	* ,, Bennington House	Rev. Dr. Parker	5	1	0	406	⅄
,,	*Knebworth—Manor House	Rev. S. R. Wigram	5	1	0	420	
14.	*Therfield Rectory	Rev. John G. Hale	5	4	3	510	⅄
,,	*Throcking Rectory	Rev. C. W. Harvey	5	1	0	487	⅄
,,	*Buntingford—Hamels Park	E. Wallis	5	1	0	400	T
15.	*Much Hadham	T. Woodham Mott	5	1	0	222	B
16.	*Harlow—Gilston Park	Edward Leach	8	0	6	175	T
17.	*Hertford—Bayfordbury	W. Clinton Baker	8	1	2	250	
,,	* ,, Sewage Works	W. B. Bryan	8	6	0	125	
,,	*Ware—Fanhams Hall	Miss V. M. Croft	8	1	0	235	T
,,	* ,, Red House	Joseph Francis	5	4	0	115	T
18.	*Hoddesdon—Feilde's Weir	W. B. Bryan	8	3	8	95	
,,	*Broxbourne—Stafford House	G. J. Newbery	5	1	0	118	T
,,	*Northaw—Northacre	Late Rev. F. W. Poland	5	1	0	392	
,,	*Hadley—Risegate	H. E. Freir	5	0	11	400	
,,	*New Barnet—Gas Works	T. H. Martin	8	0	9	215	

* Daily records received. † For explanation of these symbols see Vol. XI, p. 33.

TABLE II.—RAINFALL IN

River Districts.			Stations.	Jan.	Feb.	Mar.
				ins.	in.	ins.
OUSE	CAM	1. Rhee	Royston—Melbourne Street	2·28	·65	2·62
			Odsey	2·05	·59	2·46
	IVEL	2. Upper Ivel	Baldock—High Street	2·31	·86	2·85
		3. Hiz	Preston—The Laburnums	2·31	·95	3·22
			Hitchin—Wratten	2·52	1·03	3·22
			,, The Maples	2·49	·99	3·07
			,, The Chilterns	2·54	·77	3·29
			,, High Down	2·35	·95	2·94
THAMES	THAME	4. Up. Thame	Tring—Pendley Manor	2·85	1·15	3·65
			,, Bulbourne	2·70	1·14	3·28
	COLNE	6. Bulbourne	Wigginton Vicarage	2·77	1·20	3·58
			Cowroast	2·56	1·27	3·54
			Berkhamsted—Fairhill	2·51	1·12	3·26
			,, Rosebank	2·53	1·07	3·38
			,, Rose Cottage	2·46	1·14	3·63
		7. Gade	Great Gaddesden Vicarage	2·59	1·31	3·42
			Hemel Hempstead—Apsley Mills	2·83	1·24	3·73
		8. Ver	Kensworth—The Grove	3·23	1·45	3·29
			Harpenden—Rothamsted	2·51	1·05	3·40
			St. Albans—Gorhambury	2·60	·92	3·84
			,, Herts County Museum	2·65	1·15	3·70
			,, Bone Hill	2·66	·99	3·19
		9. Up. Colne	Frogmore—The Cottage	2·56	1·04	3·23
			Elstree—Aldenham House	2·54	·92	3·48
		10. Lo. Colne	Watford—Weetwood	2·84	·98	3·45
			,, London Orphan Asylum	2·78	·77	3·48
			,, Frogmore	2·67	·90	3·51
			,, Colne Valley Water Works	2·34	·89	3·41
			Rickmansworth—Moor Park	2·79	·80	3·43
			Eastbury—Valency House	2·38	·68	2·99
			Northwood—Easby	2·49	·76	3·11
	LEA	12. Mimram	Welwyn—Danesbury	2·19	·96	2·98
			,, Bridge House	2·49	1·13	3·33
			Datchworth Rectory	2·24	·90	3·56
		13. Beane	Weston—Weston Park	2·44	·92	3·06
			Bennington—Eileen Cottage	2·27	·97	3·19
			,, Bennington House	2·27	·82	2·88
			Knebworth—The Manor House	2·51	1·04	3·25
		14. Rib	Therfield Rectory	2·38	·56	2·88
			Throcking Rectory	2·32	·90	2·96
			Buntingford—Hamels Park	2·15	·91	2·94
		15. Ash	Much Hadham	1·94	·96	2·80
		16. Stort	Harlow—Gilston Park	2·18	1·06	3·05
		17. Upper Lea	Hertford—Bayfordbury	1·99	·98	3·14
			,, Sewage Works	1·82	·80	2·52
			Ware—Fanhams Hall	1·98	1·02	2·84
			,, Red House	1·88	·91	2·89
		18. Lower Lea	Hoddesdon—Feilde's Weir	1·68	·87	2·54
			Broxbourne—Stafford House	2·31	1·16	3·14
			Northaw—Northacre	2·14	1·08	2·95
			Hadley—Risegate	2·43	·99	2·99
			New Barnet—Gas Works	2·26	·93	3·05
			Mean for the County	2·42	·97	3·18

HERTFORDSHIRE IN 1903.

APL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR.	DAYS.
ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	
1·25	3·93	5·56	4·89	2·94	1·93	4·81	1·97	1·59	34·42	175
1·37	3·27	5·77	4·63	3·31	1·69	4·26	1·93	1·51	32·84	186
1·41	2·97	5·29	4·48	3·53	1·67	4·58	2·10	1·64	33·69	176
1·46	2·61	5·60	3·61	3·63	2·09	5·95	2·13	2·04	35·60	197
1·55	3·42	6·40	4·16	3·46	2·02	5·73	2·15	1·90	37·56	198
1·36	3·14	6·22	3·95	3·23	2·03	5·72	2·05	1·78	36·03	169
1·48	3·00	6·09	4·30	3·54	2·10	5·37	2·14	1·93	36·55	184
1·33	2·86	6·59	3·77	3·24	2·19	5·85	2·05	1·45	35·57	187
1·93	2·94	6·83	3·88	5·15	2·40	8·59	2·30	2·57	44·24	209
1·78	2·84	6·42	3·78	4·63	2·02	7·52	2·15	2·20	40·46	216
2·06	2·76	7·06	4·17	5·16	2·24	8·52	2·25	2·32	44·09	
2·08	2·63	6·65	3·62	4·34	2·49	8·29	2·22	2·64	42·33	168
1·84	2·32	5·56	3·31	3·76	2·90	7·17	1·92	2·55	38·22	182
1·90	2·13	5·53	3·21	3·64	2·56	6·98	2·26	2·69	37·88	195
1·96	2·07	5·49	3·20	3·76	2·67	7·06	2·23	2·61	38·28	196
1·58	2·47	6·29	3·35	3·64	2·13	6·64	2·39	2·30	38·11	186
1·89	2·80	5·51	3·68	3·97	2·40	7·41	2·16	2·62	40·24	179
1·87	2·97	5·65	3·99	4·60	2·54	7·53	2·53	2·46	42·11	176
1·46	2·16	5·89	3·94	3·74	2·59	6·15	2·10	2·36	37·35	186
1·60	2·15	5·37	3·27	3·98	2·37	5·79	2·01	2·44	36·34	181
1·63	2·22	6·32	3·57	3·82	2·73	6·76	1·94	2·26	38·75	192
1·63	2·19	6·16	3·70	3·86	2·45	7·22	1·82	2·22	38·09	194
1·64	2·27	6·14	3·54	3·68	2·50	7·10	1·86	2·46	38·02	191
1·76	2·52	5·68	3·30	3·92	3·10	6·82	1·62	2·08	37·74	176
1·96	2·80	5·94	3·83	3·80	2·45	7·49	1·84	2·50	39·88	198
1·88	2·67	5·74	3·49	3·45	2·39	7·50	1·69	2·26	38·10	191
1·91	2·87	6·03	3·65	3·57	2·42	8·02	1·65	2·35	39·55	181
1·78	2·65	5·56	3·42	3·34	2·36	7·99	1·60	2·35	37·69	196
1·92	3·27	4·81	3·88	3·51	2·51	7·75	1·95	2·39	39·01	210
1·81	3·11	6·01	3·54	3·45	2·21	7·44	1·66	2·05	37·33	190
2·06	2·89	5·37	3·67	3·42	2·34	7·29	1·67	1·95	37·02	175
1·28	2·26	5·83	3·81	3·86	2·82	6·13	2·19	2·23	36·54	174
1·50	2·22	6·44	3·99	4·42	3·02	5·95	2·22	2·17	38·88	185
1·43	2·39	5·80	4·73	4·27	2·30	5·74	2·05	2·15	37·35	165
1·52	2·70	5·68	4·99	3·53	2·37	5·56	2·47	1·84	37·08	203
1·61	1·99	5·49	4·55	3·54	2·34	5·84	2·33	1·80	35·92	179
1·58	1·95	5·08	5·12	3·98	2·36	5·46	2·27	1·81	35·58	218
1·49	2·70	5·40	4·39	3·81	2·49	5·73	2·09	2·29	37·19	175
1·44	3·92	6·02	5·14	3·33	1·94	5·21	2·33	1·63	36·78	201
1·49	2·97	5·56	5·04	3·14	1·91	5·93	2·36	1·78	36·36	201
1·61	2·13	5·69	4·64	3·82	2·42	5·41	2·08	1·62	35·42	161
1·73	2·22	5·57	5·79	4·21	3·17	5·54	2·04	1·68	37·65	177
1·99	2·92	6·21	5·02	5·17	3·30	6·89	2·25	1·68	41·72	166
1·32	2·05	5·19	4·41	4·03	2·67	6·84	1·91	1·91	35·65	191
1·17	2·55	5·11	4·60	3·90	2·21	5·79	1·76	1·48	33·71	
1·57	2·30	5·35	4·72	3·76	2·69	6·21	1·91	1·85	36·20	189
1·33	2·60	5·10	5·10	4·31	2·53	5·84	1·84	1·55	35·88	203
1·29	2·61	5·23	5·76	4·11	3·06	5·89	1·80	1·50	36·34	173
1·32	3·07	6·84	5·32	4·54	3·48	6·90	2·28	1·83	42·19	191
1·28	2·48	6·23	4·12	4·29	3·55	6·67	2·28	1·97	39·04	203
1·84	2·50	6·44	4·21	4·37	3·38	6·66	2·05	1·97	39·83	209
1·76	2·38	6·18	4·08	4·43	3·23	6·76	1·72	1·76	38·54	175
1·63	2·65	5·85	4·16	3·88	2·49	6·49	2·05	2·06	37·83	188

During the six months May to October 25·52 inches of rain fell, half the year thus having nearly the average yearly fall. In relation to the average, February was a dry month; November was rather dry; May was rather wet; March, July, and August were very wet; and June and October were excessively wet.

The difference in each month from the mean for the 60 years 1840–99 was as follows:—Jan., + 0·20 in.; Feb., — 0·68; March, + 1·53; April, — 0·06; May, + 0·59; June, + 3·80; July, + 1·68; August, + 1·44; Sept., + 0·14; Oct., + 3·53; Nov., — 0·51; and Dec., + 0·02.

TABLE III.—SUPPLEMENTARY TO TABLES I AND II.

District.	Station.	Observer.	Gauge.		Rainfall.	Days.
			Diameter.	Height above Sea.		
			ins.	feet.	ins.	
1.	Royston—Workhouse	H. Warren	5	217	34·02	171
,,	Odsey (2nd gauge)	H. G. Fordham	5	256 ⅄	32·38	185
	Berkhamsted—					
6.	,, Rosebank (M)	E. Mawley	8	401 ⅄	37·39	
,,	,, Rose Cottage (M)	W. E. Milner	5	334 ⅄	38·21	
8.	Harpenden—Rothamsted	A. D. Hall	8	420 ⊤	36·27	182
,,	,, ,,	,,	72 × 87	420 ⊤	38·69	
9.	St. Albans—Hill End	G. Goodchild	5	290 ⊤	35·35	166
10.	Watford—Weetwood (M)	J. Hopkinson	5	269 ⅄	39·52	
,,	,, St. Albans Road	H. Ruddle	5	250	37·67	
13.	Buntingford—Hillside	G. M. Smith	5	330 ⊤	37·28	198
17.	Hatfield—Holwell House	W. E. Laurie	5	250 ⊤	33·19	156
18.	Barnet—Summerhill	F. A. Milne	5	400	41·43	

M = gauge read monthly, in each case a second gauge.

The absolute maximum falls in any one day in each month, and the stations recording them, were: Jan. 4, Wigginton, 0·82 in.; Feb. 26, Kensworth, 0·42 in.; March 2, Northwood, 0·90 in.; April 26, Northwood, 0·67 in.; May 9, Wratten, Hitchin, 1·41 in.; June 14, Hadley, 2·25 ins.; July 23, Much Hadham, 3·15 ins.; August 24, New Barnet, 1·31 in.; Sept. 4, Broxbourne, 1·85 in.; Oct. 27, Cowroast, 1·58 in.; Nov. 27, Rosebank, Berkhamsted, 1·28 in.; Dec. 10, Frogmore, St. Albans, 0·84 in.

The day in each month on which a heavy fall of rain was most general over the county was: Jan. 4, Feb. 24, March 23 (nearly equalled by the 2nd), April 28, May 3, June 14, July 23, August 11, Sept. 10, Oct. 11, Nov. 27, Dec. 10; and in the year July 23 and Nov. 27, nearly equalled by Dec. 10. July 23 was the wettest day in the year.

The first half of the year had 85 days of rain, the second half had 103. There were 48 in the first quarter, 37 in the second, 47 in the third, and 56 in the fourth. During the Winter of 1902–3 there were 42 wet days, during the Spring of 1903 there were 46, during the Summer 43, and during the Autumn 56.

The average number of wet days in each month was as follows :— Jan., 18; Feb., 11; March, 19; April, 12; May, 15; June, 10; July, 15; August, 18; Sept., 14; Oct., 27; Nov., 15; Dec., 14.

The deviation from the mean for the 30 years 1870–99 was: Jan., + 3; Feb., — 2; March, + 6; April, — 1; May, + 3; June, — 2; July, + 1; August, + 4; Sept., + 1; Oct., + 11; Nov., — 1; Dec., — 2.

Distribution of the Rainfall throughout the County.—The next table (Table IV) gives the mean fall in each month and in the year in each of the five river-districts represented, and in the two main hydrographical divisions of the county, the catchment-basins of the Great Ouse and of the Thames, and also the difference in the year from the mean for the 20 years 1880–99.

TABLE IV.—RAINFALL IN THE RIVER-DISTRICTS.

MONTHS.	CAM.	IVEL.	THAME.	COLNE.	LEA.	OUSE.	THAMES.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Jan.	2·16	2·42	2·78	2·63	2·19	2·36	2·42
Feb.	·62	·93	1·14	1·03	·95	·85	1·00
March	2·54	3·10	3·47	3·43	2·99	2·96	3·22
April	1·31	1·43	1·85	1·82	1·50	1·40	1·67
May	3·60	3·00	2·89	2·57	2·52	3·15	2·56
June	5·67	6·03	6·63	5·85	5·73	5·94	5·83
July	4·76	4·04	3·83	3·59	4·74	4·22	4·15
August	3·12	3·44	4·89	3·83	4·04	3·36	3·97
Sept.	1·81	2·02	2·21	2·49	2·72	1·97	2·59
October	4·54	5·53	8·05	7·28	6·01	5·28	6·71
Nov.	1·95	2·10	2·23	1·97	2·11	2·06	2·05
Dec.	1·55	1·79	2·38	2·37	1·83	1·73	2·12
Year	33·63	35·83	42·35	38·86	37·33	35·28	38·29
Diff. from 1880–99	+10·80	+11·39	+17·68	+11·33	+12·68	+11·43	+12·11

The rainfall of the Colne and Lea districts deviated but slightly from the mean for the county, the Colne district having an excess of one inch and the Lea a defect of half an inch. The Ivel district had two inches less than the mean, and the Cam about four inches less, while the Thame had four and a half inches more.

The mean fall in each of the minor river-basins or sub-districts represented was as follows :—(*Cam*) Rhee, 33·63 ins.; (*Ivel*) Upper Ivel, 33·69 ins.; Hiz, 36·26 ins.; (*Thame*) Upper Thame, 42·35 ins.; (*Colne*) Bulbourne, 40·16 ins.; Gade, 39·18 ins.; Ver, 38·13 ins.; Upper Colne, 37·74 ins.; Lower Colne, 38·37 ins.; (*Lea*) Mimram, 37·59 ins.; Beane, 36·44 ins.; Rib, 36·19 ins.; Ash, 37·65 ins.; Stort, 41·72 ins.; Upper Lea, 35·36 ins.; Lower Lea, 39·39 ins.

The rainfall reached at least one inch in 24 hours ending 9 a.m. on thirteen occasions during the year; once in May, July, September, and November; twice in August and October; and five times in June. On one of these occasions in June it exceeded two inches, and in July it exceeded three inches, this excessive fall

being recorded at two stations. There are in the aggregate upwards of 200 records of at least an inch at the 45 stations for which we have the daily returns, 13 of at least two inches, and 2 exceeding three inches. The districts which usually have the smallest rainfall record the heaviest falls, all of two inches and upwards being in the districts of the Cam and Lea.

The total yearly fall ranged from 32·84 inches at Odsey to 44·24 inches at Pendley Manor, Tring; and the total monthly fall from 0·56 inch at Therfield Rectory, in February, to 8·59 inches at Pendley Manor, in October. The greatest fall in any one day was 3·15 inches at Much Hadham, on 23rd July, nearly equalled at Feilde's Weir, Hoddesdon (3·09 ins.), on the same day.

Distribution of the Rainfall in each Month.—The nomenclature used in the following account of the chief falls of rain in each month is the same as in my previous reports, falls of at least ½ inch being styled *considerable*, ¾ inch *very considerable*, 1 inch *great*, 1¼ inch *very great*, 1½ inch *heavy*, 1¾ inch *very heavy*, and 2 inches *excessive*, to which is now added *very excessive* for at least 3 inches. Only the forty-five returns of the daily rainfall are thus analysed. The wettest days in each month are given for all the fifty-two stations.

January.—Rainfall a little above the average and on a considerable number of days. Snow fell on a few days in the early part of the month. On the 4th the fall was *considerable* at 37 stations and *very considerable* at 3, and on the 27th it was *considerable* at 4 stations. The 4th was the wettest day at 48 stations, and the 27th at 4. On the night of the 17th–18th there was a glazed frost (or silver-thaw) due to hail, sleet, and then rain falling on the frozen ground, a surface-thaw coming with the rain while the moisture in contact with the ground remained frozen.

February.—A dry month, with rain on rather less than the average number of days, a very little falling as snow. This was during the last week, which was the only wet period, the rainfall during the first three weeks barely averaging 0·15 inch. There was no *considerable* fall. The 15th was the wettest day at 3 stations, the 24th at 32, the 25th at 9, the 26th at 3, the 27th at 3, and the 24th and 25th were the wettest at 2 stations.

March —A very wet month, with rain on a large number of days. A very little snow and hail fell on a few days only. On the 2nd the rainfall was *considerable* at 8 stations and *very considerable* at one station, on the 6th it was *considerable* at one station, and on the 23rd at 12 stations. The 1st was the wettest day at one station, the 2nd at 20 stations, the 6th at 3, the 23rd at 25, the 2nd and 3rd were the wettest at one station, the 14th and 23rd at one, and the 17th and 23rd at one station.

April.—A month of average rainfall on about the average number of days. All the rain but about half an inch fell on the last six days. There were a few slight falls of snow about the middle of the month. The only *considerable* fall of rain was at Easby, Northwood, on the 26th. That was the wettest day in

the month at this station only; the 28th was the wettest at 37 stations, the 30th at 12, and the 28th and 30th were the wettest at 2 stations.

MAY.—A rather wet month, with rain on a few more than the average number of days. Nearly all the rain fell in the first seventeen days, the last fourteen days having an average fall of about a tenth of an inch, but varying at the different stations from none to over half an inch due to local thunderstorms. On the 17th there was a more general thunderstorm with hail and heavy rain. On the 3rd the fall was *considerable* at 17 stations and *very considerable* at 2; on the 9th (a thunderstorm) it was *considerable* at 5 stations, *very considerable* at 3, *great* at Odsey (1·14 in.), Baldock (1·19), The Chilterns, Hitchin (1 20), and High Down, Hitchin (1·20), and *very great* at Therfield (1·39); on the 10th it was *considerable* at 3, on the 11th at 2, on the 16th at 5, and on the 17th at 3 stations. The 3rd was the wettest day at 24 stations, the 9th at 15, the 11th at 3, the 16th at 3, the 17th at 4, and the 19th at one station.

JUNE.—Excessively wet, but with rain on less than the average number of days, all the rain in the month falling during the twelve days 8th to 19th. (One station records 0·01 in. on 24th, probably dew.) On the 8th the fall was *considerable* at 3 stations, on the 9th at 22, on the 10th at 3, on the 11th at one station, and on the 12th at one. Three very wet days follow, with at least a *considerable* fall at all stations on each day. On the 13th the fall was *considerable* at 6 stations; *very considerable* at 17; *great* at The Chilterns, Hitchin (1·11 in.), High Down, Hitchin (1·02), the County Museum, St. Albans (1·01), Weetwood, Watford (1·00), London Orphan Asylum, Watford (1·01), Bridge House, Welwyn (1·10), Eileen Cottage, Bennington (1·04), Bennington House (1·02), Therfield (1·04), Throcking (1·08), Hamels Park (1·15), Much Hadham (1·15), Gilston Park (1·20), Bayfordbury (1·03), Hertford Sewage Works (1·05), Fanhams Hall, Ware (1·05), Red House, Ware (1·00), Feilde's Weir (1·07), Hadley (1·20), and New Barnet (1·22); and *very great* at Broxbourne (1·36) and Northaw (1·32). On the 14th the fall was *great* at Throcking (1·20 in.); *very great* at Preston (1·47 in.), Northwood (1·48), Danesbury, Welwyn (1·41), Datchworth (1·30), Weston Park (1·45), Bennington House (1·31), Knebworth (1·27), Hamels Park (1·32), Much Hadham (1·39), Hertford Sewage Works (1·48), Fanhams Hall, Ware (1·35), and Red House, Ware (1·40); *heavy* at Baldock (1·56 in.), The Chilterns, Hitchin (1·64), High Down, Hitchin (1·60), Apsley Mills (1·56), Gorhambury (1·62), Bone Hill, St. Albans (1·57), Frogmore, St. Albans (1·58), Moor Park (1·68), Bridge House, Welwyn (1·64), Eileen Cottage, Bennington (1·50), Therfield (1·71), Gilston Park (1·50), Bayfordbury (1·66), and Feilde's Weir (1·74); *very heavy* at Fairhill, Berkhamsted (1·75 in.), Rosebank, Berkhamsted (1·80), Rose Cottage, Berkhamsted (1·75), Great Gaddesden (1·75), Kensworth (1·85), Rothamsted (1·83), the County Museum, St. Albans (1·85),

Aldenham House (1·96), Weetwood, Watford (1·86), London Orphan Asylum, Watford (1·81), Frogmore, Watford (1·99), Colne Valley Water Works, Watford (1·85), Eastbury (1·78), and Northaw (1·84); and *excessive* at Odsey (2·07 ins.), Broxbourne (2·24), Hadley (2·25), and New Barnet (2·14). And on the 15th it was *very considerable* at 10 stations; *great* at Apsley Mills (1·13 in.), Rothamsted (1·16), Gorhambury (1 20), the County Museum, St. Albans (1·16), Bone Hill, St. Albans (1·13), Frogmore, St. Albans (1·13), Weetwood, Watford (1·14), Moor Park (1·07), Bayfordbury (1·02), Hertford Sewage Works (1·04), Red House, Ware (1·12), and Broxbourne (1·20); *very great* at Odsey (1·41 in.), Baldock (1·34), Rosebank, Berkhamsted (1·43), Rose Cottage, Berkhamsted (1·44), Great Gaddesden (1·47), Kensworth (1·40), Danesbury, Welwyn (1·38), Eileen Cottage, Bennington (1·45), Bennington House (1·40), Hamels Park (1·44), Much Hadham (1·33), Gilston Park (1·42), and Fanhams Hall, Ware (1·32); *heavy* at Preston (1·55 in.), The Chilterns, Hitchin (1·51), High Down, Hitchin (1·63), Fairhill, Hitchin (1·51), Bridge House, Welwyn (1·55), Datchworth (1·65), Weston Park (1·66), Knebworth (1·59), and Therfield (1·66); and *very heavy* at Throcking (1·76 in.). On the 16th 1·04 was recorded at High Down, Hitchin, but there was not even a *considerable* fall at any other station in the county on that day. Lastly, on the 19th the fall was *considerable* at 33 stations and *very considerable* at 10; at two stations (Odsey and Baldock), completing the 45, it was just under half an inch. The 11th was the wettest day at one station, the 14th at 43 stations, the 15th at 7, and the 13th, 14th, and 15th were the wettest at one station. The excessive rainfall caused serious floods in various parts of the county.

July.—Also a very wet month, with rain on about the average number of days, nearly all in the latter half of the month. Up to the 16th the average fall was about 0·03 inch, on from one to three days. On the 17th the fall was *considerable* at 9 stations; on the 18th it was *considerable* at 4 and *very considerable* at one station; and on the 19th it was *considerable* at 6 stations and *very considerable* at one station. On the 23rd it was *considerable* at 2 stations; *very considerable* at 7; *great* at Preston (1·16 in.), Great Gaddesden (1·04), Kensworth (1·12), Rothamsted (1·14), Frogmore, St. Albans (1·06), Weetwood, Watford (1·04), London Orphan Asylum, Watford (1·07), Frogmore, Watford (1·05), Colne Valley Water Works, Watford (1·00), Eastbury (1·00), and Northwood (1·08); *very great* at The Chilterns, Hitchin (1·43 in.), High Down, Hitchin (1·27), Danesbury, Welwyn (1·36), Bridge House, Welwyn (1·39), Knebworth (1·30), Hadley (1·36), and New Barnet (1·34); *heavy* at Datchworth (1·54 in.), Eileen Cottage, Bennington (1·70), Bennington House (1·71), and Northaw (1·58); *very heavy* at Bayfordbury (1·78 in.) and Fanhams Hall, Ware (1·90); *excessive* at Odsey (2·19 ins.), Baldock (2·02), Weston Park (2·01), Therfield (2·75), Throcking (2·00), Hamels Park (2·05), Gilston Park (2·14), Red House, Ware (2·51), Hertford

Sewage Works (2·16), and Broxbourne (2·30); and *very excessive* at Much Hadham (3·15 ins.) and Feilde's Weir (3·09). On the 25th the fall was *considerable* at 27 stations and *very considerable* at 10; on the 26th it was *considerable* at 3, on the 27th at 5, and on the 29th at 2 stations. The 23rd was the wettest day at all (52) stations.

August.—The third successive very wet month, with rain on a large number of days. On the 11th the fall was *considerable* at 7 stations, *very considerable* at 34, and *great* at Preston (1·06 in.), Bridge House, Welwyn (1·00), Datchworth (1·02), and Bayfordbury (1·00); on the 20th it was *considerable* at 8 stations; and on the 24th it was *considerable* at 26 stations, *very considerable* at 4, *great* at Kensworth (1·13 in.), Feilde's Weir (1·02), Broxbourne (1·15), and Hadley (1·10), and *very great* at Gilston Park (1·25 in.) and New Barnet (1·30). The 11th was the wettest day at 40 stations and the 24th at 12.

September.—Rainfall and number of rainy days about the average. On the 4th the fall was *considerable* at 4 stations, *very considerable* at 2, *great* at Gilston Park (1·15 in.), Bayfordbury (1·11), Hertford Sewage Works (1·13), and Red House, Ware (1·17); *very great* at Much Hadham (1·42 in.), Fanhams Hall, Ware (1·25), Northaw (1·51), and Hadley (1·47); and *heavy* at Feilde's Weir (1·55 in.). It will be noticed that all these stations are in the Lea river-basin. On the 10th it was *considerable* at 25 stations and *very considerable* at 6, and on the 24th it was *considerable* at 2 stations and *very considerable* at one station (our three Berkhamsted stations only, a very local fall). The 4th was the wettest day at 16 stations, the 10th at 35, and the 24th at one station (Fairhill, Berkhamsted). On each of these three days the rainfall was caused by thunderstorms, that on the 10th being accompanied by a gale of wind which did some damage; but the most severe thunderstorm in the month occurred on Saturday the 12th, when damage was done by lightning at Codicote, near Welwyn, and Birch Green, near Hertford.

October.—An excessively wet month, the wettest in the year, and with rain nearly every day, only four, on the average, being without rain, several stations having only one fine day, and one observer recording a measurable quantity (at least 0·01 in.) every day. On the 8th the fall was *considerable* at 20 stations and *very considerable* at one station (Kensworth). The 11th was much the wettest day: the fall was *considerable* at 3 stations; *very considerable* at 27; *great* at Apsley Mills (1·08 in.), Rothamsted (1·15), the County Museum, St. Albans (1·08), Weetwood, Watford (1·06), Frogmore, Watford (1·02), Colne Valley Water Works, Watford (1·21), Feilde's Weir, Hoddesdon (1·05), Hadley (1·13), and New Barnet (1·16); and *very great* at Aldenham House (1·32 in.), London Orphan Asylum, Watford (1·27), and Northaw (1·30). On the 12th the fall was *considerable* at 3 stations, on the 21st at one station, on the 25th at 5 stations, and on the 26th at 4. The next day was a very wet one generally, the fall on the 27th being

considerable at 21 stations; *very considerable* at 12; *great* at Fairhill, Berkhamsted (1·04 in.), Rosebank, Berkhamsted (1·05), Rose Cottage, Berkhamsted (1·01), Apsley Mills (1·01), Weetwood, Watford (1·00), and Frogmore, Watford (1·00); and *very great* at Kensworth (1·25 in.). The eighth was the wettest day at 2 stations, the 11th at 38, and the 27th at 12. The floods caused by the excessive rainfall on ground already saturated were almost as serious as those of June.

November.—Rather dry, with rain on about the average number of days. The 27th was a very wet day throughout the county, all the 45 stations from which daily returns have been received recording it as at least *very considerable*, and it was the wettest day in the month at the whole of the 52 stations. The fall was *very considerable* at 20 stations; *great* at Odsey (1·03 in.), Baldock (1·00), Preston (1·09), The Chilterns, Hitchin (1·05), Apsley Mills (1·18), Kensworth (1·22), Rothamsted (1·14), Gorhambury (1·06), Danesbury, Welwyn (1·16), Bridge House, Welwyn (1·15), Datchworth (1·05), Weston Park (1·13), Eileen Cottage, Bennington (1·19), Bennington House (1·05), Knebworth (1·02), Therfield (1·23), Throcking (1·20), Hamels Park (1·13), Gilston Park (1·03), Broxbourne (1·20), Northaw (1·00), and Hadley (1·04); and *very great* at Rosebank, Berkhamsted (1·28 in.), Rose Cottage, Berkhamsted (1·27), and Great Gaddesden (1·28). On no other day in the month was there a *considerable* fall. A little snow fell on the 30th.

December.—A month of average rainfall on rather less than the average number of days. Nearly all the rain fell during the first twelve days, the amount after the 12th varying from about a tenth to a fifth of an inch at the different stations. On the 9th the fall was *considerable* at one station, and on the 10th it was *considerable* at 27 stations and *very considerable* at 2. The 9th was the wettest day at one station, the 10th at 50 stations, and the 12th at one station. A little snow fell at the beginning and end of the month.

Comparison with the Rainfall of the Adjoining Counties.—The rainfall in Hertfordshire in the year 1903 was, as usual, in excess of the average in the adjoining counties. The mean rainfall in the year at the same stations as in the previous year, except that in two instances stations have been discontinued and others have had to be substituted, was as follows:—Cambridgeshire (21 stations), 30·17 ins.; Bedfordshire (12 stations), 33·75 ins.; Buckinghamshire (18 stations), 37·94 ins.; Middlesex (7 stations), 38·06 ins.; and Essex (33 stations), 33·23 ins.; the mean for the whole of the 91 stations (one to every 40 square miles in each county) being 33·85 ins. This shows an excess for Hertfordshire of about four inches, or a little over 9 per cent., which is considerably more, both in amount and proportion, than in the previous year, and also more in amount, though a less proportionate excess, than usual.

XV.

NOTES ON LEPIDOPTERA OBSERVED IN HERTFORDSHIRE IN THE YEAR 1903.

By A. E. Gibbs, F.L.S., F.R.H.S.

Read at Watford, 29th March, 1904.

It is satisfactory, at the close of a season which has proved so disappointing from an entomologist's point of view, to be able to announce the addition to our county list of no less than nine species of Lepidoptera—seven of them being macros. It is true that these records cannot all be credited to 1903, but they come to hand opportunely, and the majority of them are the result of last season's work. This addition raises the total number of species on our list to 1,158.

I am pleased to report that I have secured the co-operation of an observer at Hitchin, in a district of the county possessing a rich insect fauna, but which has been much neglected so far as our annual reports are concerned since the death of that old and valued correspondent, and painstaking and observant naturalist, Mr. Frank Latchmore. Our new observer, Mr. A. H. Foster, of The Grange, Hitchin, who, I am glad to say, has become a member of the Society, has sent to me some valuable notes, and five of the new records have been supplied by him. Of the remaining four, Mr. A. H. Goodson, of Tring, has contributed two; Miss Alice Dickinson, of New Farm, St. Albans, one; and Mr. P. J. Barraud, of Bushey Heath, one.

The species new to our list are:—

1. *Tapinostola Hellmanni*, Evers. Hitchin. A. H. Foster.

One example of this species came to light at Mr. Foster's residence, The Grange, Hitchin, at about 12 o'clock midnight, and being an unexpected capture he was at some pains to get its identification confirmed. It has been submitted to Mr. C. G. Barrett, one of our best authorities on Lepidoptera, and he pronounces it to be correctly named. While looking through an old collection made by Mr. William Hill, of Hitchin, Mr. Foster discovered four other examples of *T. Hellmanni* and also specimens of *Leucania albovenosa* and *Calamia phragmitidis*, which Mr. Hill believes were taken locally, but he is not sufficiently certain to permit them to be recorded. He has indicated the locality in which he thinks they occurred, and Mr. Foster has undertaken to make further investigations during the coming season. The chief home of *T. Hellmanni* in our Islands is the Fen district of Cambridgeshire and Huntingdonshire, and it is not altogether to be wondered at that it should find its way to damp spots in those parts of our county which lie on the Cambridgeshire border.

2. *Mamestra furva*, Hb. Hitchin. A. H. Foster.

This was taken at light in the house by Mr. Foster in 1902, and was at first supposed to be *M. brassicæ*. The specimen has been

examined by Mr. Barrett, and its determination is confirmed by him. It is a moth which one hardly expected to find in Herts, as it is a west-country hill-frequenting species.

3. *Agrotis aquilina*, Hb. Hitchin. A. H. Foster.

In addition to a specimen captured at light by Mr. Foster, he reports the presence of two in the collection of Mr. Grellett, of Hitchin, which were taken last season.

4. *Noctua glareosa*, Esp. Ashridge. A. T. Goodson.

Mr. Goodson reports the capture during the past season of a good series of *Noctua glareosa* at Ashridge. They were found by searching the heather-bloom on the Common at night with a lantern.

5. *Dicycla oō*, L. St. Albans. Miss Alice Dickinson.

This very local species was taken at sugar on an apple-tree in the garden at New Farm, St. Albans, on 15th July, 1903, between 9 and 10 p.m., by Miss Dickinson. It is a welcome addition to the county list, and I hope it has come to stay. It is essentially a south-country insect, though its range extends northwards to Suffolk, Hunts, and Northamptonshire, and it is recorded from the adjoining county of Essex. The New Forest appears to be its headquarters.

6. *Polia chi*, L. Hitchin. A. H. Foster.

This was bred in 1902 from a larva found feeding on monkshood, when Mr. Foster was searching for pupæ of *Plusia moneta*. The specimen, which he was good enough to show me, is a remarkably light-coloured variety. Mr. C. G. Barrett informs me that *P. chi*, which has generally been regarded as a northern insect, has been working south lately.

7. *Asthena sylvata*, Hb. Hitchin. A. H. Foster.

Taken at light in 1902. This is a Geometer which should be searched for, as it ought to occur in various parts of Hertfordshire.

8. *Pyrausta aurata*, Scop. Tring. A. T. Goodson.

Two specimens of this beautiful little Pyralid were taken after diligent search by Mr. Goodson on the *Lucina*-ground at Dancer's End on the Bucks border. *P. aurata* may be looked for on grassy banks in May, July, and August. The larvæ feed under a web in May and September on various species of *Mentha* and other Labiate plants. This species we might have looked for from Tring, for it is essentially a lover of Chalk downs, and is common in some south-country localities.

9. *Eriopsela fractifasciana*, Haw. Aldbury. P. J. Barraud.

This, the only addition to our list of Hertfordshire Tortrices during 1903, was taken at Aldbury on May 25th by Mr. Barraud, when he obtained two specimens by beating a hedge on the Downs.

An interesting result of the work of local lepidopterists during the last few seasons has been the confirmation of several records made by Stephens in the early years of the nineteenth century, thus re-establishing in our list species which it was feared had disappeared from the county. James Francis Stephens, who may

be called the Father of British Entomology, was born on the 16th of September, 1792, and early developed a love of this branch of natural science. At the age of 16 he commenced to compile lists of the insects of Britain, and enumerated 3,673 species, of which 1,367 were Lepidoptera. He was a clerk in the Admiralty, and devoted his spare time to collecting, and being an indefatigable worker he accumulated large and admirably-arranged collections of all orders of insects. He was a Fellow of the Linnean and Zoological Societies, and a member of the Entomological Societies of London and of France. In 1837 he occupied the presidential chair of the Entomological Society. Besides being the author of numerous papers and articles printed in scientific periodicals and in the Journals and Transactions of the learned societies, he published in 1828 'A Systematic Catalogue of British Insects'; in 1829, 'The Nomenclature of British Insects'; and in 1839, 'The Manual of British Coleoptera.' But his *magnum opus* was his 'Illustrations of British Entomology, a Synopsis of Indigenous Insects,' in ten volumes, dated 1827 to 1846, the four volumes on Lepidoptera appearing between 1828 and 1835. This great work, in which he intended to describe all known species of British insects, was not, however, completed, the Hemiptera and Diptera being omitted altogether, and the Hymenoptera being only partly described. In the formation of his celebrated collections Stephens made frequent visits to many localities in the vicinity of London, the neighbourhood of Hertford being a favourite hunting-ground. His 'British Entomology' contains a large number of records of Lepidoptera, Coleoptera, Orthoptera, and Neuroptera from that locality, and these form our first, and, in the case of some orders, our only local lists. So far as the Lepidoptera are concerned Stephens' Hertfordshire records were collected together by Mr. John Hartley Durrant, F.E.S., and embodied in a valuable paper which is printed in our 'Transactions.' The Coleoptera noted by Stephens have been dealt with by Mr. E. George Elliman in his able article on the Beetles of the county in the 'Victoria History of Hertfordshire,' and the comparatively few records of insects of other orders have been enumerated by me in the same work. Stephens died in 1852. In 'British Entomology' the monarch of British butterflies, *Apatura iris*, the purple emperor, is stated to have occurred near Hertford in July, 1833, and from that time until now, so far as I am aware, no note of the presence of this insect in our county has appeared. I am glad to learn that there is a likelihood, amounting almost to a certainty, that it is still with us, and I sincerely hope that in next year's Report I may be able to definitely reinstate the purple emperor in our list. For some most interesting notes on the subject I am indebted to Mr. A. H. Foster, who saw, but having no net was unable to catch, a specimen in 1899 or 1900, settled on some dung in the middle of the road which leads by the side of Hitch Wood towards Whitwell. Mr. Foster believes that *A. iris* is to be found in Hitch Wood and also in Knebworth Great Wood, Mardley Heath Woods, and Welwyn Tunnel Woods. The keepers both at

Knebworth and Welwyn informed him a few years ago that they not infrequently saw a beautiful purple butterfly settling on dead birds, rats, etc., hanging in their "larders." I agree with Mr. Foster that although this is only hearsay evidence it is very suggestive, and coupled with the sight which he obtained of a specimen near the wood, it appears to be conclusive. Mr. Foster further informs me that the late Mr. Frank Latchmore used to tell how, whilst driving by Hitch Wood, he saw a specimen settled in the road, and how he stopped his horse and tried to catch it with his hat, but failed, an experience very similar to Mr. Foster's. Another of Stephens' early records which has received confirmation is that of the occurrence of *Acontia luctuosa*. For this also we are indebted to Mr. Foster, who possesses two local specimens, one taken on Willbury Hill in 1902, when he missed a second, and another captured in a clover-field on the top of Pegsden Hills in 1903. Mr. Grellett also took a specimen last year near Hitchin. *A. luctuosa* is generally regarded as a south-country insect, but Mr. Barrett says that it is extending its range. Another of Stephens' insects which has again been noted is *Myelophila cribrella*, a pretty spotted black and white Pyralid, which was taken at light at Cheshunt by Mr. Boyd. There is no reason why *cribrella* should not be taken in other parts of the county, for the food-plant is abundant. The larvæ feed in the stems of thistles, and the cocoon, in which pupation takes place in the spring after hybernation, is formed inside the excavated stem. The moths are to be found settled on the thistle-heads in July and August. I have discovered them in considerable numbers in Suffolk, and have even found them come to sugar.

The year 1903 will long be remembered by entomologists as one of the worst seasons on record. The long-continued spell of cold wet weather was apparently the chief cause of the great scarcity of insects. Hundreds of young larvæ must have been drowned on their food-plants, and doubtless the low temperature which prevailed throughout the greater part of the Summer prevented the emergence of imagos, causing the pupæ to lie over until another season. From all quarters the same complaint of a dearth of insects is heard. Mr. Arthur Cottam, who usually contributes valuable material for the annual Report, is unfortunately unable this year to afford any assistance in consequence of the bad weather, and his experience in this respect is, alas! only that of field-naturalists throughout the country. Writers in the entomological magazines have told the same story of woe. "Light" was unattractive, "sugar" a failure, and "dusking" yielded poor results. The excessive rainfall and the prevailing low temperature were most prejudicial to insect-life, and consequently collectors experienced a very poor season. The bright interval at the beginning of October appears to have been the sole redeeming feature of a bad year. So far as my own garden at St. Albans is concerned, I never remember seeing so many insects at sugar as were to be found on several evenings at this time. *Polia*

flavicincta was especially abundant, a score of them being taken on one round on the few patches of sugar spread on my apple-trees, and among other species which appeared at the same time in some abundance may be named *Noctua C-nigrum*, *Anchocelis pistacina*, *A. lunosa*, *A. litura*, *Cerastis spadicea*, *C. vaccinii*, and *Hypena rostralis*. Of the last-named a long and variable series was taken. Other insects which came in smaller numbers to sugar in October included *Noctua plecta*, *Mania maura*, and the common red underwing, *Catocala nupta*, which has a habit of settling on the bark of trees or on a fence, the mottled greys of its fore-wings harmonising remarkably well with its surroundings and rendering it almost invisible except to the trained eye of the experienced entomologist. In order to illustrate this curious instance of protective colouration I have brought for inspection a specimen taken last Autumn on an old apple-tree in my garden; and when viewed from a short distance, sitting as it is with its wings closed, I think that you will not find it easy to detect its presence. With it are some examples which have the wings expanded, showing the brightly-coloured posteriors, and in this attitude the moth is a striking object.

At this same period of bright autumn weather there occurred a great immigration of the painted lady butterfly (*Vanessa cardui*). This beautiful insect was to be seen in abundance almost everywhere, even I am told in Hyde Park and other open spaces in the Metropolis. There is a curious feature about this influx of painted ladies—they were of a much lighter colour than they usually are with us, a fact which Mr. Barrett thinks shows them to be migrants from some warm country where bright sunshine forced them forward and prevented the deepening of their hues. They were present in Hertfordshire as elsewhere, delighting the eye in all our gardens as they flew from blossom to blossom. Lord Aldenham wrote to me on October 12th, drawing attention to the abundance of *V. cardui* in his grounds. He informed me that among them were four very beautiful insects which he thought might be *V. huntera*, a North American species which has occurred several times in England. Having no net with him, Lord Aldenham could not capture them, and therefore it is impossible to say with absolute certainty that we have been favoured with a visit from this interesting Nearctic species. An unfortunate break-up of the weather—for the bright spell did not last long—prevented me from availing myself of Lord Aldenham's kind invitation to investigate the matter for myself. Another butterfly which was particularly numerous at this time was the red admiral (*V. atalanta*), which settled on the michaelmas daisies, opening and closing its scarlet-banded wings with a fan-like rhythmic motion after the manner of its kind. The patches of sugar which had served as allurements to Noctuæ on the previous night proved very attractive, and I could have easily captured dozens, sitting on the tree trunks sunning themselves and sipping the attractive sweets.

Turning now to the reports from correspondents, I will deal first with the notes received from Mr. Foster, of Hitchin.

Besides the five species which he has been able to add to our list, Mr. Foster records the capture of many interesting insects, among them being *Thecla w-album*, *Trochilium bembeciformis*, *Ino geryon*, *Notodonta dromedarius*, *Cymatophora ocularis*, *Agrotis ravida*, *Xanthia aurago*, *Aporophyla lutulenta*, *Plusia moneta*, *Aplecta advena*, *Acontia luctuosa*, *Eurymene dolobraria*, and others which will in due course be entered in our Record-book. The confirmation of the Rev. G. H. Raynor's record of the presence of *Aporophyla lutulenta* in North Herts is worthy of notice. This species is now shown to occur at Hitchin in fair numbers, though it does not appear in Mr. Durrant's list. Mr. Foster informs me that Mr. Grellett took about half-a-dozen at sugar in the Autumn, as did also Mr. Foster himself. Mr. Grellett's collection includes *Thyatira derasa*, *Caradrina taraxaci*, *Xanthia citrago*, *Anchocelis rufina*, *Hadena protea*, and *Hemerophila abruptaria*, all taken in the town or its vicinity.

Miss Alice Dickinson, of New Farm, St. Albans, a diligent worker who generally manages to add to our list, and who this year has been so fortunate as to secure *Dicycla oō* in her garden, has, considering the season, met with a fair amount of success during 1903. The first entomological note of the year refers to the capture by her sister, on a telegraph-post on February 16th, of the early grey moth, *Xylocampa lithoriza*, a species which I have myself secured on the palings at Hawkswick in the same neighbourhood. On May 22nd *Hylophila prasinana* emerged in the breeding-cage, the larva having been taken in Hawkswick Wood in the previous September. *Ennychia octomaculata*, an insect which Miss Dickinson first discovered in the county in 1901, when she captured near St. Albans the specimen now in the cabinet at the County Museum, was seen but not taken on the scrub at Bricket Wood. Other Noctuæ which she reports are *Thyatira derasa*, *Hydræcia nictitans*, *Cerigo matura*, *Dipterygia scabriuscula*, *Miana fasciuncula*, *M. literosa*, *M. bicoloria*, *Agrotis suffusa*, *A. saucia*, *Noctua plecta*, *Triphæna janthina*, *T. fimbria*, *Anchocelis lunosa*, *A. litura*, *Cerastis vaccinii*, *C. spadicea*, *Scopelosoma satellitia*, *Calymnia diffinis*, *Euplexia lucipara*, *Gonoptera libatrix*, *Plusia moneta*, *P. chrysitis*, *P. iota*, and *Catocala nupta*. Among the Geometers are *Selenia illunaria*, *S. lunaria* (from larvæ taken in Sparrowswick Wood), *Hemerophila abruptaria*, *Asthena candidata*, *Acidalia promutata*, *A. imitaria*, *Cabera pusaria*, *C. exanthemata*, *Lomaspilis marginata*, *Anisopteryx æscularia*, *Emmelesia alchemillata*, *E. subfulvata*, *Eupithecia centaureata*, *Melanthia albicillata*, *Melanippe unangulata*, *M. rivata*, *M. montanata*, *Coremia ferrugata*, *C. unidentaria*, *Triphosa dubitata* (at sugar), *Cidaria immanata*, *C. fulvata*, *C. pyraliata*, *Anaitis plagiata*, and *Eubolia cervinata* (larva). Two Bombyces reported are *Bombyx quercus*, a larva of which was brought from Bernards Heath, fully fed, on August 31st, and a goat moth, *Cossus ligniperda*, taken on an apple-tree on July 22nd.

Mr. P. J. Barraud again furnishes an interesting list of captures at Bushey Heath. He says: "The season of 1903 was even worse than that of 1902. During the whole year Lepidoptera were conspicuous by their absence, even the common species being seldom observed. As in the preceding year, the only attraction which was of any use during the summer months was 'light,' but nothing at all rare was taken. One specimen of the lesser lutestring (*Asphalia diluta*) came into the light-trap on September 23rd, and one pale-shouldered brocade (*Hadena thalassina*) on June 8th; these two are the only species which are new to my list for this locality. Of the other species taken in this way the following were the rarest, the earliest date of appearance of each species being placed in brackets after the name:—*Notodonta dictæoides* (July 19th), *Pachnobia rubricosa* (April 28th), *Selenia lunaria*, males (June 6th), *Habrostola tripartita* (June 12th), *Dipterygia pinastri* (June 30th), *Gonoptera libatrix* (March 21st), *Luperina cespitis* (August 30th), *Plusia chrysitis* (July 4th), *Epione apiciaria* (August 30th), *Pericallia syringaria* (July 16th), *Herminia tarsipennalis* (July 9th), *Aphomia sociella* (July 4th), *Crambus perlellus* (July 9th), *Tortrix fosterana* (June 29th), *Penthina ochroleucana* (July 9th), *P. cynosbana* (July 10th), *Spilonota rosæcolana* (July 4th), *S. roborana*, *Sciaphila nubilana* (July 7th), and *Yponomeuta cognatella*. Sugaring was practically useless until the Autumn, but the following were then taken in my garden with other commoner species:—*Agrotis suffusa* (October 3rd), *A. segetum* (October 3rd), *Xanthia fulvago* (September 12th), *Meselia oxyacanthæ* (October 17th), *Hadena protea* (September 13th), and *Catocala nupta* (September 12th). There is not much ivy-bloom in this district, and that was soon ruined by the heavy rains. The only species seen on it worth boxing was *Orthosia macilenta*, of which I secured a few. Larvæ of *Triphæna fimbria* were found in the early spring by searching in the garden with a lantern after dark. The moths emerged in June. On two occasions I cycled to the Tring district in quest of Lepidoptera, and met with very fair success. The first visit was on May 25th, when *Thanaos tages* was the butterfly most in evidence, while only a single *Syrichthus malvæ* was seen. *Pieris napi*, *P. rapæ*, *P. brassicæ*, and *Euchloë cardamines* were also noted, and two *Thecla rubi* netted. Of the Heterocera I took *Corremia ferrugata*, *Strenia clathrata*, *Xylopoda fabriciana*, and *Eriopsela fractifasciana*. On my second visit (July 25th and 26th) I was accompanied by Mr. T. F. Furnival, and considering the inclement weather we did fairly well. To us the most interesting find was *Mimæoptilus phæodactylus*, which was locally common among small patches of *Ononis spinosa*. This little moth seems seldom to take wing by day unless disturbed, and requires to be carefully sought for amongst the shoots of the food-plant. *M. pterodactylus* was also taken in herbage; it flies more freely by day than the preceding. By beating and searching the hedges, etc., we obtained *Ephyra linearia* (*trilinearia*), *Larentia pectinataria* (*viridaria*), *Cidaria dotata* (*pyraliata*), *Eubolia bipunctaria*, *Botys hyalinalis*,

Scopula lutealis, *Phibalocera quercana*, *Dichelia grotiana*, *Sericoris lacunana* (*herbana*), *Orthotænia striana*, *Catoptria cana*, and *Yponomeuta plumbella*; while from a brick wall we took *Bryophila perla* and *Eupithecia subfulvata*. After dark we searched a large patch of thistles with a lantern, and boxed odd specimens of *Leucania impura*, *L. pallens*, *L. lithargyria*, and *Caradrina morpheus*. On neither day were butterflies much in evidence, for during the greater part of the time it was wet and dull, but we took *Epinephile hyperanthes*, *E. janira*, and *Polyommatus corydon*. *Pyrausta purpuralis* was common in one meadow late in the afternoon of the 26th, when the sun made its appearance. *Hypæna proboscidalis* was also taken. Just before leaving we hunted round the stables at the Hotel, and were rewarded with a number of very good examples of *Aglossa pinguinalis*, one *Pyralis farinalis*, and about half-a-dozen *Tinea tapetzella* on an old horse-collar."

Mr. A. T. Goodson, of Tring, regrets that his notes this year are somewhat scanty, owing partly to absence from home and partly to the very inclement weather. *Notodonta ziczac* and *Cymatophora ocularis* were bred from larvæ found at Wilstone Reservoir. A nice series of *Xylophasia sublustris* was taken at the same spot, and one specimen at Aldbury Nowers at sugar. *Chærocampa porcellus* was discovered in copula at the Nowers, but a diligent search made on two occasions was not rewarded by the finding of any larvæ of this species. *Sphinx convolvuli* was brought to him alive by his brother, who found it on the pathway in Langdon Street. Butterflies were decidedly scarce, even *Polyommatus corydon*, which is generally very plentiful, not appearing in its wonted numbers.

XVI.

METEOROLOGICAL OBSERVATIONS TAKEN IN HERTFORDSHIRE IN THE YEAR 1903.

By John Hopkinson, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C. E.

Read at Watford, 19th April, 1904.

There has been no change in the Hertfordshire meteorological stations since the year 1898, and the observations in 1903 have been taken as hitherto. The hour of observation is 9 a.m. All the observations are entered to the same day except those of the maximum temperature and the rainfall, which are entered to the previous day. Shade temperatures only are given; those for Bennington, Berkhamsted, and St. Albans being from thermometers in Stevenson screens, and for New Barnet from thermometers under a Glaisher stand.

For information as to the stations reference should be made to my paper on "The Climate of Hertfordshire" in the previous volume of our 'Transactions' (pp. 125–126). The averages with which the results for 1903 are compared are those for the twelve years 1887–1898 as given in that paper, except for the rainfall, which is compared with the average for the county for the sixty years 1840–1899, given at p. 132 of the same paper.

Table I.—*Results of Climatological Observations taken in Hertfordshire in the Year* 1903.

Stations	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Bennington	48·6	41·8	55·1	13·3	20·9	84·0	83	7·4	35·58	219
Berkhamsted	48·7	41·4	58·9	14·5	20·4	82·9	83	7·2	37·88	195
St. Albans	48·7	42·3	55·1	12·8	22·3	83·2	81	7·1	38·75	192
New Barnet	49·1	40·0	58·1	18·1	18·5	87·8	81	6·8	38·54	175
County.....	48·8	41·4	56·1	14·7	18·5	87·8	82	7·1	37·69	195

The year was rather warm on the whole, the mean temperature being half a degree above the average. The mean daily range was 1°·2 below the average, owing almost entirely to the warmth of the nights. The air, at 9 a.m., was of average humidity. The sky, at the same hour, was rather more cloudy than usual, there were more sunless days, and the sun shone brightly for about 35 minutes a day less than its average duration. The rainfall was much the greatest recorded since the year 1852, and the wet days

were unusually numerous. South-westerly winds prevailed, and westerly were the next in frequency.

Compared with the average, February was a very warm month, and January, March, and October were warm; June was very cold, and April and August were rather cold. The air was drier than usual in April, June, and July, and more humid in December. The sky was brighter than usual in January, very cloudy in December, and rather so in February and October. June had nearly three times the average rainfall, October more than double, March nearly double, and July and August about one-half more than the average; February was a dry month. Rain fell nearly every day in October, and was very frequent in January, March, and August.

TABLE II.—*Means of Climatological Observations (with Extremes of Temperature) for the Seasons of* 1902–1903.

Seasons	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Winter	40·9	35·8	46·0	10·2	16·0	59·8	88	7·4	4·86	45
Spring	46·7	38·2	55·2	17·0	21·0	81·5	78	6·6	7·14	48
Summer	57·9	49·0	66·8	17·8	31·8	87·8	74	6·7	13·74	43
Autumn	50·3	43·5	57·2	13·7	24·2	83·9	86	7·3	11·26	61

The Winter of 1902–3 (Dec. to Feb.) was very mild, both days and nights being much warmer than usual. The air was of average humidity, and the sky of average brightness at 9 a.m., but the duration of sunshine was 21 minutes a day less than usual. The rainfall was rather less than the average, but of frequent occurrence. The wind was mostly south-westerly.

The Spring (March to May) was of about average temperature, that of both the days and the nights being about the same as usual. The air was of average humidity, and although the sky was of average brightness at 9 a.m., the duration of sunshine was nearly an hour a day less than usual. The rainfall was heavy and frequent. South-westerly winds prevailed.

The Summer (June to August) was cold, chiefly owing to the low day-temperature. The air was of average humidity, and the sky of average brightness at 9 a.m., but the duration of sunshine fell short of the average by 42 minutes a day. The rainfall was exceptionally heavy, being nearly double the average, but very little more frequent than usual. The wind was mostly north-easterly in June, and from the west-south-west later.

The Autumn (Sept. to Nov.) was rather warm, chiefly owing to the warmth of the nights. The air was of average humidity, and the sky was cloudy at 9 a.m., the duration of sunshine, 17 minutes

a day less than usual, only in this season of the year showing any correspondence with the amount of cloud at this hour. The rainfall was very heavy, and there were many wet days. The prevailing direction of the wind was south-westerly.

TABLE III.—*Means of Climatological Observations (with Extremes of Temperature) taken at Bennington, Berkhamsted, St. Albans, and New Barnet, during the Year* 1903.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	39·2	34·2	44·1	9·9	18·5	54·9	90	6·7	2·43	18
Feb.	44·0	37·8	50·3	12·5	19·0	59·8	86	7·8	·99	12
March	44·4	36·7	52·2	15·5	21·0	67·8	82	6·8	3·25	19
April	43·3	35·0	51·5	16·5	21·5	62·8	76	6·6	1·72	14
May	52·3	42·7	61·8	19·1	26·5	81·5	76	6·5	2·17	14
June	54·7	45·7	63·7	18·0	31·8	86·1	73	6·5	5·78	10
July	60·4	51·5	69·3	17·8	36·9	87·8	72	6·9	3·99	14
August	58·5	49·7	67·2	17·5	37·8	78·2	76	6·8	3·97	19
Sept.	56·2	47·5	65·0	17·5	32·8	83·9	83	6·5	2·72	15
Oct.	51·3	45·2	57·3	12·1	31·0	67·8	87	7·3	6·49	28
Nov.	43·6	37·9	49·3	11·4	24·2	58·0	89	8·0	2·05	17
Dec.	37·1	33·0	41·2	8·2	20·0	52·0	92	8·4	2·13	15
Year	48·8	41·4	56·1	14·7	18·5	87·8	82	7·1	37·69	195

JANUARY.—A very warm month, with an atmosphere of average humidity, a bright sky, and a rainfall only slightly exceeding the average, but on a large number of days. Both days and nights were warm. The only cold period was from the 11th to the 18th, these eight days having a mean temperature about 9° below that of the month (Berkhamsted mean 30°·0, St. Albans 30°·6). The minimum temperature was below 32° on ten days at both Berkhamsted and St. Albans. The duration of sunshine was a little shorter than usual. The prevailing direction of the wind was S.W. There was a "glazed frost" on the night of the 17th–18th, the ground being covered with a thin sheet of ice in the morning.

FEBRUARY.—Exceptionally warm, the mean temperature being 6°·3 above the average, with an atmosphere of average humidity, a cloudy sky, and a small rainfall. Both days and nights were warm. The minimum temperature was below 32° on only four days at Berkhamsted and three at St. Albans. The duration of sunshine was a little below the average. The prevailing direction of the wind was south-westerly with a slight westerly tendency.

MARCH.—Another very warm month, but with the temperature only about half as much above the average as that of February, with an atmosphere of average humidity, a sky of average brightness, and nearly double the average rainfall on a large number of

TABLE IV. — *Climatological Observations taken at* BENNINGTON HOUSE, BENNINGTON. *Latitude:* 51° 53′ 45″ N. *Longitude:* 0° 5′ 20″ W. *Altitude:* 407 *feet. Observer:* REV. J. D. PARKER, LL.D., F.R.Met. Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	38·9	34·5	43·2	8·7	20·9	52·9	91	7·2	2·27	20
Feb.	43·7	38·0	49·5	11·5	27·7	58·2	88	8·0	·82	12
March	44·4	37·2	51·6	14·4	25·9	66·8	86	6·6	2·88	19
April	43·0	35·4	50·5	15·1	27·2	57·9	78	7·3	1·58	16
May	51·9	43·3	60·6	17·3	34·1	75·8	76	6·6	1·95	17
June	54·3	46·1	62·4	16·3	38·5	80·8	73	6·5	5·08	10
July	60·3	51·9	68·7	16·8	42·0	84·0	73	7·2	5·12	16
August	58·2	50·1	66·4	16·3	42·9	75·0	76	7·5	3·98	21
Sept.	56·2	48·5	63·8	15·3	37·8	81·2	83	6·7	2·36	17
Oct.	50·7	45·1	56·3	11·2	34·4	65·9	88	7·7	5·46	29
Nov.	43·1	38·2	48·1	9·9	29·9	53·0	90	8·4	2·27	24
Dec.	36·8	33·2	40·3	7·1	24·6	49·1	94	9·1	1·81	18
Year	48·6	41·8	55·1	13·3	20·9	84·0	83	7·4	35·58	219

TABLE V.— *Other Meteorological Observations taken at Bennington by the Rev. Dr. Parker.*

Months	Pressure of the atmosphere	Temperature at 9 a.m.				Days of		Bright Sunshine		
		of the air	of evaporation	of the soil		clear sky	overcast	Total hours	Max. in one day	Sunless days
				at 1 ft.	at 2 ft.					
	ins.	°	°	°	°					
Jan.	30·021	37·9	36·9	39·0	40·0	4	19	42	5·7	17
Feb.	·159	42·5	41·0	42·2	42·5	4	17	67	7·5	9
March	29·884	43·6	41·8	42·9	43·2	6	10	114	8·6	5
April	·927	43·2	40·2	44·7	45·2	3	12	115	10·0	5
May	·929	52·8	49·2	52·4	51·6	6	15	169	14·2	2
June	30·072	56·1	51·8	57·1	56·6	2	13	173	13·7	7
July	29·968	60·8	56·1	63·0	62·4	2	13	182	14·5	0
August	·898	59·0	55·1	60·2	60·3	1	13	194	13·2	0
Sept.	30·061	56·6	53·9	58·0	58·4	3	12	162	11·8	1
Oct.	29·693	51·3	49·6	52·9	53·9	3	17	84	7·5	6
Nov.	30·079	43·0	41·7	45·6	47·1	2	13	59	6·8	11
Dec.	29·809	36·5	35·8	39·8	41·3	1	21	29	5·8	21
Year	29·958	48·6	46·1	49·8	50·2	37	175	1390	14·5	84

TABLE VI. — *Climatological Observations taken at* ROSEBANK, BERKHAMSTED. *Latitude :* 51° 45′ 40″ N. *Longitude :* 0° 33′ 30″ W. *Altitude :* 400 *feet. Observer :* EDWARD MAWLEY, F.R.Met. Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	39·4	34·8	43·9	9·1	20·4	53·5	91	6·3	2·53	18
Feb.	44·1	37·7	50·5	12·8	21·4	58·7	87	7·8	1·07	11
March	44·3	36·7	52·0	15·3	23·9	66·0	82	7·2	3·38	19
April	43·5	35·0	52·0	17·0	24·3	60·3	75	6·6	1·90	14
May	52·2	42·7	61·6	18·9	30·4	76·6	77	6·5	2·13	15
June	54·3	45·4	63·3	17·9	37·1	81·6	74	6·7	5·53	10
July	60·1	51·5	68·6	17·1	41·1	83·9	72	7·3	3·21	16
August	58·3	50·0	66·7	16·7	40·9	75·5	78	6·9	3·64	18
Sept.	56·5	48·1	64·9	16·8	35·1	81·0	84	6·8	2·56	16
Oct.	51·3	45·3	57·2	11·9	34·1	66·6	88	6·9	6·98	27
Nov.	43·4	37·3	49·5	12·2	26·4	56·4	91	8·4	2·26	14
Dec.	36·8	32·8	40·9	8·1	23·7	50·4	94	8·5	2·69	17
Year	48·7	41·4	55·9	14·5	20·4	82·9	83	7·2	37·88	195

TABLE VII. — *Other Meteorological Observations taken at Berkhamsted by Mr. Mawley.*

Months	Pressure of the atmosphere	Temperature at 9 a.m.				Days of		Bright Sunshine		
		of the air	of evaporation	of the soil		clear sky	overcast	Total hours	Max. in one day	Sunless days
				at 1 ft.	at 2 ft.					
	ins.	°	°	°	°					
Jan.	29·994	37·7	36·7	37·8	39·8	6	11	46	5·4	15
Feb.	30·141	42·5	40·9	42·2	42·8	3	14	70	7·1	8
March	29·855	43·7	41·4	43·2	43·9	3	6	125	8·3	6
April	·898	43·6	40·2	45·4	46·3	4	13	133	9·3	4
May	·898	52·7	49·2	54·0	52·9	5	10	157	13·1	2
June	30·054	56·2	52·0	58·8	58·2	3	12	154	12·4	7
July	29·946	60·9	56·1	63·5	62·8	1	9	158	12·0	3
August	·876	58·8	55·1	60·9	61·3	1	10	163	11·3	1
Sept.	30·036	56·4	53·9	58·7	59·4	4	10	146	10·4	4
Oct.	29·652	51·1	49·4	52·9	54·9	3	13	77	6·7	7
Nov.	30·063	42·8	41·6	44·8	47·5	3	16	52	5·7	9
Dec.	29·769	36·7	36·1	38·5	41·2	2	20	20	4·0	22
Year	29·932	48·6	46·1	50·1	50·9	38	144	1301	13·1	88

days. As in January and February, both days and nights were warm. The temperature was below 32° on four days at both Berkhamsted and St. Albans. The duration of sunshine was a little shorter than usual. The prevailing direction of the wind was S.S.W.

April.—The first cold month in the year, the mean temperature being below that of both February and March, with a rather dry atmosphere, a sky of average brightness, and about the average rainfall. The low temperature was due almost entirely to the coldness of the days, the mean daily range being very small for the month. The temperature was below 32° on ten days at Berkhamsted and eleven days at St. Albans, all within the thirteen days 13th to 25th, the coldest period in the month. The duration of sunshine fell short of the average by more than an hour a day. The prevailing direction of the wind was W.N.W. The frosty nights did much damage to fruit-blossoms.

May.—An average month in almost all respects, the mean temperature being exactly the average, the humidity and cloud nearly so, and the rainfall only slightly in excess. The mean daily range of temperature was also about the average. The duration of sunshine, however, fell short of the average by nearly an hour and a quarter a day. The wind came mostly from the south-west. There were a few very warm days towards the end of the month, the maximum temperature on the 22nd being 76° at Berkhamsted and 75°·6 at St. Albans, on the 30th 76°·6 at both places, and on the 31st 75° at Berkhamsted and 73° at St. Albans.

June.—A very cold month, the mean temperature being 4°·3 below the average, with a rather dry atmosphere, a sky of average brightness, and an excessive rainfall (nearly three times the average), but very few wet days, each having, on the average, more than half an inch of rain. The low temperature was chiefly due to the coldness of the days. The 1st was a hot day, the maximum being 80° at Berkhamsted and 78°·6 at St. Albans; after this it was only on the last five days that 70° was exceeded, the mean temperature of these days being more than 4° higher than that of the month (Berkhamsted mean 64°·2, St. Albans 64°·9). The duration of sunshine was an hour a day less than usual. North-easterly winds greatly prevailed, an unusual quarter for a summer month. Serious floods were caused by the heavy rain.

July.—Rather cold, with a rather dry atmosphere, a sky of about average brightness, and a heavy rainfall (about 50 per cent. above the average). The mean night temperature was slightly above the average, the low temperature of the month being entirely due to the coldness of the days; the mean daily range was therefore smaller than usual. The maximum temperature reached at least 80° on the 2nd (Berkhamsted 80°, St. Albans 80°·3), 10th (Berkhamsted 83°·9, St. Albans 83°·0), and 11th (Berkhamsted 83°, St. Albans 82°·3), and 75° on one other day only, the 9th (Berkhamsted 77°, St. Albans 75°·7). The sun shone for about three-quarters of an hour a day less than usual. The prevailing direction of the wind was from the W.S.W.

TABLE VIII.—*Climatological Observations taken at the* HERTFORDSHIRE COUNTY MUSEUM, ST. ALBANS. *Latitude:* 51° 45′ 15″ N. *Longitude:* 0° 19′ 56″ W. *Altitude:* 389 *feet. Observer:* JOHN HOPKINSON, V.P.R. Met. Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	39·5	34·7	44·3	9·6	22·3	52·8	89	7·0	2·65	18
Feb.	44·1	38·9	49·4	10·5	25·9	58·1	86	7·6	1·15	12
March	44·3	37·7	51·0	13·3	26·3	65·2	82	6·8	3·70	20
April	43·0	36·0	50·1	14·1	27·7	57·5	76	6·3	1·63	14
May	51·8	43·3	60·3	17·0	35·0	76·9	76	6·5	2·22	14
June	54·8	47·0	62·6	15·6	39·4	81·6	72	6·7	6·32	10
July	60·3	52·8	67·9	15·1	43·8	83·2	71	6·9	3·57	13
August	58·1	50·5	65·7	15·2	43·0	75·1	75	6·5	3·82	18
Sept.	56·2	48·7	63·8	15·1	38·0	81·5	82	6·4	2·73	15
Oct.	51·5	46·3	56·6	10·3	35·0	64·7	86	7·3	6·76	28
Nov.	43·6	38·6	48·6	10·0	29·3	54·6	88	7·8	1·94	16
Dec.	37·3	33·5	41·2	7·7	24·7	48·4	92	8·8	2·26	14
Year	48·7	42·3	55·1	12·8	22·3	83·2	81	7·1	38·75	192

TABLE IX. — *Climatological Observations taken at the* GAS WORKS, NEW BARNET. *Latitude:* 51° 39′ 5″ N. *Longitude:* 0° 10′ 15″ W. *Altitude:* 212 *feet. Observer:* T. H. MARTIN, Assoc. M. Inst. C.E.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	38·8	32·8	44·8	12·0	18·5	54·9	89	6·3	2·26	17
Feb.	44·1	36·4	51·7	15·3	19·0	59·8	84	7·9	·93	11
March	44·7	35·2	54·2	19·0	21·0	67·8	80	6·7	3·05	20
April	43·5	33·7	53·3	19·6	21·8	62·8	75	6·3	1·76	12
May	53·2	41·6	64·7	23·1	26·5	81·5	75	6·4	2·38	12
June	55·3	44·1	66·4	22·3	31·8	86·1	73	6·1	6·18	9
July	60·9	49·7	72·1	22·4	36·9	87·8	74	6·3	4·07	11
August	59·3	48·4	70·1	21·7	37·8	78·2	76	6·5	4·43	18
Sept.	56·1	44·6	67·6	23·0	32·8	83·9	84	6·1	3·23	13
Oct.	51·7	44·2	59·1	14·9	31·0	67·8	85	7·3	6·77	27
Nov.	44·1	37·3	50·8	13·5	24·2	58·0	86	7·4	1·72	14
Dec.	37·3	32·3	42·3	10·0	20·0	52·0	89	8·6	1·76	11
Year	49·1	40·0	58·1	18·1	18·5	87·8	81	6·8	38·54	175

August.—A cold month, with an atmosphere of average humidity, a rather cloudy sky, and a heavy rainfall (as in July about 50 per cent. above the average). The low temperature was chiefly due to the coldness of the days, the mean daily range being smaller than usual. The maximum temperature exceeded 70° on the 8th and 13th only (8th, Berkhamsted 75°·5, St. Albans 75°·1; 13th, Berkhamsted 72°, St. Albans 71°·1). The duration of sunshine was a little less than usual. The wind was mostly from the W.S.W.

September.—A very similar month to May, the mean temperature, humidity, and cloud being about the average, and the rainfall only slightly exceeding it. The mean daily range of temperature was a little below the average. The maximum temperature exceeded 70° on the 1st and 2nd only, which were hotter than any days in August (1st, Berkhamsted max. 79°, St. Albans 79°·6; 2nd, Berkhamsted max. 81°·0, St. Albans 80·5). The duration of sunshine was about the same as usual. The wind was mostly from the W.S.W. There was a gale on the night of Thursday the 10th which did much damage to trees, chiefly in the neighbourhood of St. Albans and Watford, falling trees on the road between these places rendering it dangerous for a time, and impeding traffic. There was a severe thunderstorm on the 12th, by which some damage was done near Hertford.

October.—Very warm, with an atmosphere of average humidity, a cloudy sky, and an excessive rainfall (more than double the average) on an exceptionally large number of days. The rain was, in fact, almost continuous, only three days being without, and the total fall exceeding that in any other month of this excessively wet year. The high temperature was chiefly due to warm nights, the mean daily range being small. The sun shone for about fifty minutes a day less than usual. The wind was mostly from the S.S.W. Floods occasioned by the heavy rainfall almost equalled those of June.

November.—A month of about average temperature and humidity, with a cloudy sky, and rather less than the average rainfall on a considerable number of days. The mean daily range of temperature was exactly the average. The temperature was below 32° on four days at Berkhamsted and three at St. Albans. The duration of sunshine was about the average. Westerly winds prevailed.

December.—Of about average temperature, with a rather humid atmosphere, a very cloudy sky, and about the average rainfall on the usual number of days. The first seven and the last three days were cold, with minima below 32° on each day at both Berkhamsted and St. Albans; the only other day in the month with the minimum below 32° was the 27th (at both places). The 5th was the coldest day in the year, the maximum temperature at Berkhamsted being a little below 32°, and at St. Albans a little above it. The sun shone for about forty minutes a day less than usual. Easterly winds prevailed.

XVII.

NOTES ON BIRDS OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1903.

By William Bickerton.

Read at Watford, 19th April, 1904.

It will be remembered that up to the close of the year 1902 the register of our county birds contained the names of 219 species. Two instances of the visits of birds not hitherto recorded for the county have been brought to my notice during 1903, so that the number now stands at 221. It may serve a useful purpose to state that of this number, 40 (inclusive of the two species reported to-night) have been recorded as visiting our county once only, while 76 of the 221 have been seen less than five times. The two species now to be added to our list are the purple heron (*Ardea purpurea*) and the black-necked or eared grebe (*Podicipes nigricollis*). A few words about these may add to the interest of our records.

1. The Purple Heron (*Ardea purpurea*).—A note in the 'Zoologist' for March, 1903, recorded the fact that an immature specimen of this species had visited the watercress-beds at Castle Farm, near Harpenden, in November, 1902, and that it had been shot and passed on to the taxidermist. Ultimately it was secured for our County Museum at St. Albans. As will be surmised, the species is only an "accidental visitor" to the British Isles, in which about 50 specimens have been altogether obtained, mostly on the east coast of England. Only one specimen has been noticed in Ireland and three in Scotland. Its summer range for nesting purposes includes practically the whole of the countries of Southern Europe in which suitable marshy areas occur. Its nearest nesting haunts to us are the marshes of Holland, where it is not uncommon. It also breeds freely in the marshy districts of the Loire, in the Spanish Peninsula, and from Central Germany to the swampy parts of Southern Russia. In the cold season it leaves the whole of the countries north of the Mediterranean and winters in North Africa, in Abyssinia, and in suitable localities so far south even as Madagascar and Cape Colony. Mr. H. Saunders states that "in its habits the purple heron is shy, and crepuscular or even nocturnal in its time of feeding. From the thinness of the long, snake-like neck, the birds are with difficulty distinguished when they are standing in a reed-margined lake, nearly up to the breast in water; for their bodies in the shimmering sunlight exactly resemble tussocks of rushes. The food consists of small mammals, reptiles, fishes (especially eels), and aquatic insects." The adult bird has the crown and long plumes glossy purplish-black—hence the name. The plumes, however, are absent even in the adult birds in Winter, and in the young birds they do not appear until after the second moult. The length of the adult bird is 33 inches.

2. The Black-necked or Eared Grebe (*Podicipes nigricollis*).—The Hon. Walter Rothschild reports that "two specimens of this

bird were seen by the Hon. Charles Rothschild on Wilstone Reservoir near Tring, in November, 1903. One of these, a young male, was obtained; the other was seen for some time, but afterwards disappeared." This interesting record enables me to state that the whole of the five grebes known to British ornithology have now been observed in Hertfordshire, although for two out of the five—the red-necked grebe (*Podicipes griseigena*) and *P. nigricollis*—only one appearance is recorded, and in each case at the Tring Reservoirs. Like the purple heron, this grebe is chiefly a southern species, which occasionally comes so far north, or rather north-west, as the British Isles, and is most frequently taken on our north-eastern coasts. Mr. Hartert states that it nests freely in East Prussia. Mr. Saunders states that "southward from Germany it breeds in suitable localities throughout the greater part of Europe, becoming abundant in the countries bordering the Mediterranean and Black Seas; while it is even more plentiful in North Africa, whence it ranges southward to the Cape." It is curious to note that Canon Tristram found this grebe nesting "in societies more densely crowded than any rookery," and that the nests "were raised on artificial islets, frequently almost touching each other, and sometimes piled on stout foundations rising from more than a yard under water." The adult male in breeding plumage has the head and neck black, with a triangular patch of long hair-like feathers of a golden chestnut colour on the ear coverts. Doubtless from these two characteristics it has received its trivial names of "black-necked" and "eared" grebe. It is noteworthy, however, that both the black on the throat and the golden "ear-tufts" disappear with the autumn moult. The length of the adult bird is given as 12 inches.

General Notes.

Missel-Thrush (*Turdus viscivorus*) and Song-Thrush (*Turdus musicus*).—It is the general opinion of all the correspondents who have favoured me with notes during the last two years that these birds are decidedly on the increase in all parts of the county. From the information one sees in the natural-history papers and magazines, it is evident that this increase obtains practically throughout the whole country. With regard to the early nesting of the thrushes, I may state that I saw a new thrush's nest so early as February 15th, near Grove Mill, but as it was not easily accessible I could not ascertain whether it was that of the missel-thrush or song-thrush, or whether it contained any eggs. Mr. Thompson, of Elstree, reports a song-thrush's nest, containing five eggs, at Boreham Wood, on March 16th. I heard thrushes in full song both during the first week in January and the last week of December, 1903, and from the general results of my own observation I think that a few birds can be heard in song during every month of the year excepting perhaps August and September.

Redwing (*Turdus iliacus*) and Fieldfare (*T. pilaris*).—Although these birds were fairly numerous in the early months of the year, I did not notice a single specimen of either of them in the Watford

district during the autumn and winter months at the close of the year. This is rather unusual, and makes 1903 the only one of the last five years in which I have not seen these winter visitors between October and December. Mr. Gibbs informs me that in the St. Albans district the redwing was much scarcer and the fieldfare rather more plentiful than usual.

Blackbird (*Turdus merula*).—Mr. E. Hartert (Tring) reports the following circumstance, almost unique I should think, in regard to the nesting habits of this species:—"I found a blackbird's nest underground about five feet inside a large entrance hole dug by marmots in Tring Park. It could only be reached by lying down flat. It contained, however, no eggs or young."

Wheatear (*Saxicola œnanthe*).—Mr. E. P. Thompson reports that on August 26th he saw a wheatear at Elstree, and that this is the first occasion on which he has seen it in that locality. It may be of interest to state that this is the first note of the occurrence of the wheatear in the county that I have received during the past three years, so that it looks as if the visits of this striking bird are either very few or very rarely noticed and recorded.

Redbreast (*Erithacus rubecula*).—Mr. T. Brown (Hatfield) reports that he found a robin's nest in an old lantern lying in a cart-shed. The glass on one side of the lantern was broken. Mr. Gibbs reports a nest of the species found in an old tin.

Nightingale (*Daulias luscinia*).—There is a pretty general opinion among my correspondents that nightingales were either very scarce or very silent during the Summer of 1903. Thus Mr. Hartert (Tring) reports: "Very few nightingales were heard, but probably they did not sing so much as in years with better weather." And Mr. H. G. Fordham (Odsey) reports: "The nightingale has hardly been heard at all this Spring; whether they have not come to this part of the country, or the wet weather has prevented their singing, I do not know. In 1902 there were few, or they did not sing much, but the present year has been remarkable for the absence of song." It is also noteworthy that they were unusually late in arrival, doubtless owing to the cold and boisterous season.

Grasshopper-Warbler (*Locustella nævia*).—This was another of our usual summer visitors which could not accommodate itself to the unhappy climate of last year. Mr. Barraud reports that whereas the species usually haunts Bushey Heath in Spring and Summer, not a single specimen was seen or heard during 1903.

Hedge-Sparrow (*Accentor modularis*).—Mr. E. P. Thompson reports that a nest of this species containing two eggs was found at Elstree on January 24th. This is a remarkably early date.

Waxwing (*Ampelis garrulus*).—Mr. A. E. Gibbs informs me that a pair of waxwings have been presented to the St. Albans Museum, and that they were two of four birds captured near Watford in the earlier part of the year. This is the first record of the appearance of the waxwing in the county since 1895. There are only eight previous visits recorded, and these range from 1850 to 1895.

Goldfinch (*Carduelis elegans*).—I am extremely glad to be able to chronicle a continued increase, if only to a small extent, in the number of our goldfinches. Mr. F. Shillitoe (Hitchin) reports a "slight increase." Mr. E. Hartert states that "goldfinches were seen more frequently than during recent years, but not during nesting season," while Mr. T. Brown (Hatfield) reports that "goldfinches are certainly more plentiful." My own observations tend also in the same direction, for on four different occasions (one in January, two in February, and one in September) I have come across specimens in Cassiobury Park. On the first occasion a single specimen was seen feeding in company with redpolls and siskins in the alder-trees; on the second a party of four in a similar situation, and similarly associated; on the third a small flock of about a dozen associated with tits and chaffinches were trying to extract seeds from the heads of thistles—long dead and dry, but still erect; while in September a party of three were seen similarly occupied, though naturally with much better results at that time of year.

Siskin (*Chrysomitris spinus*) and Lesser Redpoll (*Linota rufescens*).—These birds were common enough in the winter months at the beginning of the year, but so far as the Watford district is concerned I did not see a specimen of either towards the close of the year (October to December).

House-Sparrow (*Passer domesticus*).—Mr. Gibbs reports that a nest of this species built in an old teapot was sent to the Museum. It had been found in a hedge at Sandridge. This is decidedly an unusual nesting-site for this most prolific species.

Bullfinch (*Pyrrhula europæa*).—Mr. F. Shillitoe reports that "numbers of bullfinches have been seen at Preston and elsewhere in the Hitchin district." I have certainly seen them myself more frequently around Watford during 1903 than during any of the four preceding years.

Starling (*Sturnus vulgaris*).—This bird is universally reported to be on the increase, and so much so that it is becoming in some districts quite a pest to those woodland birds that nest in the holes of trees. Some of my correspondents go so far as to say that the increasing scarcity of the woodpeckers especially is due to their being dispossessed by starlings of the nesting-holes they have excavated in the trees. Thus Mr. T. Brown (Hatfield) reports: "Woodpeckers are scarcer owing probably to nesting-places being almost all occupied by starlings. Some eight or ten years ago I found numbers of woodpeckers' nests, chiefly greater spotted, but for the last few years I have not seen one of that species." The powers of mimicry of this ubiquitous and enterprising bird are well known to all observers. Mr. Barraud sends an interesting note on this: "We noticed last Summer that the starlings frequenting our garden (probably it was one particular bird) very frequently imitated the curious bubbling note of the hen cuckoo. At first we believed that one of the latter species was actually about the garden, but subsequently we caught the starling red-handed several times. The imitation was perfect. Another starling (or perhaps

the same bird) imitated very accurately the sound of hammers striking an anvil. There is a blacksmith's close to us, where doubtless the bird frequently heard the sound."

Magpie (*Pica rustica*).—I think it is worth recording that in January last I saw for the first time within five years a specimen of this fine though apparently diminishing bird. The locality was between Chorleywood and Chenies. Some of the keepers of my acquaintance, however, tell me that the bird is not nearly so rare as is generally supposed, though they all do their best to reduce its numbers, owing to its fatal fondness for the eggs and young of the partridge and pheasant.

Skylark (*Alauda arvensis*). — Mr. M. R. Pryor reports the unusual experience that there was not an appreciable number of immigrant skylarks in the district during the Winter of 1903–4.

Green Woodpecker (*Gecinus viridis*).—I am indebted to Mr. T. Brown, of Symond's Hyde, Hatfield, for the following interesting account of the habits of the green woodpecker in the nesting season. "In 1902 a pair of green woodpeckers commenced making a hole for nesting purposes in an old apple-tree in the orchard here, but, after working some time, they gave it up, probably finding the work rather hard. They returned to the same place in 1903 and continued operations. After working very laboriously for a considerable time they got the hole deepened to their satisfaction, as they laid eggs in it. The hole when completed was carried about 5 inches horizontally and 16 inches in depth. The pair took the work of excavating in turns, working about a quarter of an hour each, at the end of which time they appeared rather exhausted. They must use some signal when about to change, because as soon as the one ceased work and left the hole, the other was ready to enter, even when it had not been within sight of the hole. Frequently, when one was at work, the other was about the tree ready to make a dash at any sparrow or starling that seemed to think of appropriating the hole. So long as the boring was carried on from the outside the birds invariably adopted the same position, viz., when pausing the left foot grasped the lower edge of the hole, and the other the tree a few inches further down. As soon as the pecking was commenced, the right foot released its hold and hung dangling in the air. When the hole got so deep that the chips could not be dropped outside without the birds moving from their position, the chips were placed on the horizontal part of the hole, and when a number had accumulated there, the bird came up and pushed them out with his bill, quite a quantity at each stroke. The chips were not carried away as is the case with tits, but were dropped close to the tree. I was rather surprised one day to see the length of time a starling, at a great disadvantage, kept up an attack on one of the woodpeckers, the latter being in the hole with only its head protruding, and the starling had to keep hovering on the wing, close to the mouth of the hole. When collecting food for their young the parents do not carry it in their bills, but in their crops, and just before feeding

each of the young ones they bring up a portion, apparently the allowance for one, into their mouth, repeating this until all are fed. The visits to the young were at long intervals. The morning the young birds left the nest, July 8th, they were very restless and noisy, as if aware that some important step was about to be taken. About 5 a.m. one old bird came, as if to feed the young, but, instead of feeding, it kept moving slowly backwards from the hole, thus inducing the one that was looking out (and there was always, after the birds had attained a good size, one young bird looking out) to leave the hole, and follow the parent round the tree. In a short time both took to the wing and disappeared. After this the remaining young got more restless and noisy than ever. The next did not leave the hole till about 6.30, the others left at shorter intervals, and all had gone by 9 a.m. The old birds did not come near the hole to entice any of them out except the first. Unfortunately, during a recent gale, the greater part of the apple-tree was blown down, otherwise there might have been an opportunity for further observation next season. The tree was well situated for the purpose, being only a few yards from a window. I am hoping that the birds may yet return and make a fresh hole in the remaining part of the tree."

Hen-Harrier (*Circus cyaneus*).—One of the keepers in the Watford district informed me that on March 10th he saw a hen-harrier near Chandler's Cross, but as he was without his gun at the time he could not obtain it. The bird has only been recorded for Hertfordshire four times previously.

Wood-Pigeon (*Columba palumbus*).—Mr. H. G. Fordham reports: "There was an extraordinary quantity of wood-pigeons in this part of the county (Odsey) from January onwards. Apparently they were attracted by the great crops of sheep-food—cabbage, turnips, etc., to which they did much harm till quite late in the Spring."

Corn-Crake (*Crex pratensis*).—I heard only one (near King's Langley) during the whole of the Summer, and this is only the second time I have heard this species within four years. It is somewhat difficult to account for its increasing scarcity in the Southern and Home Counties. I may add that while spending a few days' holiday at Whitby in June last I found this bird apparently common, almost every cornfield having at least one pair.

Golden Plover (*Charadrius pluvialis*).—The Hon. A. Holland-Hibbert informs me that in January he saw a party of six at Munden.

Great Crested Grebe (*Podicipes cristatus*).—Mr. E. P. Thompson informs me that a bird of this species visited Elstree Reservoir on April 13th.

The following birds are reported as being more plentiful than usual during 1903:—Missel-thrush, song-thrush, fieldfare, blackbird, robin, greenfinch, goldfinch, linnet, bullfinch, starling, rook, and ring-dove.

The birds in the subjoined list are reported as being scarcer than usual:—Redwing, nightingale, lesser whitethroat, swallow, house-martin, sand-martin, siskin, lesser redpoll, skylark (autumn

immigration only), swift, wryneck, greater and lesser spotted woodpeckers, and partridge.

Cuckoos' eggs are reported as having been found in the nest of the hedge-sparrow and yellow-hammer.

Though I cannot place the record in our Hertfordshire list, I think it is worthy of note that, as Mr. Gibbs informs me, a pair of nutcrackers (*Nucifraga caryocatacte*) have been secured for the Museum at St. Albans. They were killed in Bedfordshire just beyond our county border. These birds have never yet been taken or seen actually in Hertfordshire.

From the rough general notes which I have been able to give, it will be seen that the cold and wet Summer of 1903 was a most unfortunate one for our birds in general and for our summer visitors in particular. The comparative geniality of the early Spring had induced some of the migrants to come earlier than usual. The subsequent cold and wet of April and of the following months seem to have affected them in the following ways:—(1) Many of the singing-birds were much more silent than usual. (2) In one or two cases birds which come practically every year do not appear to have come at all, or at all events they were never seen or heard during the season. See grasshopper-warbler (*ante*). Another correspondent writes: "Swifts did not come to their usual nesting places here at all." (3) Many of the April and May visitors were very late in coming, and even when they did arrive they had to postpone their nesting operations to an unusually late period. (4) Many old birds, especially those dependent on insects for food, died from starvation. Many of the young of those that did succeed in nesting must also have fared very badly. Thus one correspondent reports: "Many young birds perished, e.g., thrushes, blackbirds, titmice, partridges."

During the Summer the following incident was brought to my notice, and in the hope that it may be of interest and possibly of assistance to some of our members, I have thought well to give it a place in my report. Early in May the Hon. A. Holland-Hibbert, a gentleman who takes a considerable interest in birds, requested me to visit Munden in order to inspect a nest in his garden, as the identification of the bird, nest, and eggs was somewhat puzzling. The nest was built about five feet from the ground, and was near one side of a thick, evergreen, closely-grown tree on the lawn. One had to push the branches aside before obtaining a view of the nest, which was, roughly speaking, somewhat more bulky than a blackbird's. The cup, however, was much smaller than is usual in the blackbird's nest, though the foundation was about twice as large, and was put together rather loosely and in a somewhat slovenly manner. It was built of dry stalks of grass and leaves, with a good deal of moss about the cup, the inside of which was entirely formed of this material. Mr. Holland-Hibbert informed me that it had contained four eggs, all of a pure white colour, and with a smooth, glossy surface. Only one of the four had escaped destruction, and this was shown

to me. It was noteworthy that the egg was of irregular shape; in fact, it was not "bilaterally symmetrical" as all normal eggs are, but had an unusual malformation on one side. Roughly speaking, it was a little smaller than the egg of a hedge-sparrow. Mr. Holland-Hibbert also told me that he had obtained a similar egg from a similar kind of nest the year preceding, but that in this case the nest had been built on the inside ledge of the roof of a summer-house in another part of the garden. I was able to see an egg from the 1902 nest side by side with one from the 1903 nest, and they were alike in all respects. The bird itself was described as very elusive and difficult to see, inasmuch as it left the nest immediately anyone approached, and slipped down amongst the undergrowth and bushes very stealthily. Only one of the members of the household had caught a passing glimpse of it, and described it as being "red in front, something like a robin."

After gleaning all the facts possible and carefully weighing all the evidence both as to the birds, nest, and egg, I came to the conclusion which had gradually been forming in my mind, viz., that the nest and eggs were those of the redbreast. The circumstances, however, were quite abnormal, and failing a sight of the bird, they were sufficiently so to mislead any naturalist who had not been brought face to face with a difficulty of the kind before. The considerations which influenced me in arriving at this conclusion were the following. (1) The irregular and abnormal shape of the egg clearly betokened some malformation in the bird's oviduct, and the fact that the eggs taken in two separate, yet successive, years were similarly misshapen, clearly demonstrated this. (2) Granting a malformation in the oviduct, the fact that the eggs were totally different from the normal eggs of the robin in shape, size, and colour is easily explained, for an abnormally developed oviduct might easily produce eggs differing in all these respects from normal eggs. These eggs were pure glossy white, with no trace of spots or markings of any kind. Here, again, the fact that two years' eggs in succession were similarly abnormal strengthens the conclusion. (3) The bulky nature of the nest and the slovenly manner in which it was built, together with the quantity of moss about the cup, strengthens the view as to its being a robin's. (4) From the well-known character of the robin for building in unexpected or "curious" situations, there is nothing peculiar in this one building one year on a ledge in a summer-house and the next in a well-sheltered side of an evergreen five feet high and out in the open. (5) The fact that the lady who saw it had the impression that, generally speaking, it was "like a robin," strengthens the evidence. (6) The whole argument was confirmed in my mind by a somewhat similar incident brought to my notice several years ago in a large Midland city where I then lived. A lad living in the country brought to me some peculiar eggs that no one could identify. They were almost exactly of the size and shape of the kingfisher's eggs, but instead of the white glossy surface of such eggs they were of a uniform light sky-blue and of

an unusually rough texture. They were taken from a nest built mostly of leaves in a hedge-bank, and here again it was noteworthy that there was a difficulty in catching sight of the bird. I was quite at a loss to know to what bird they belonged, and after carefully comparing them with a very fine collection of eggs in the local museum I found nothing like them there. They were then submitted to the Professor of Natural History at the local University College: he also failed to identify them, though he again carefully compared them with the eggs in the museum collection. They were next exhibited at a meeting of the local naturalists' society, at which several expert oologists were present, but no clue as to their identification was forthcoming. Finally, the lad was advised to catch the bird after nightfall, and this he did, the bird, much to the surprise of all who had seen the eggs, turning out to be a robin.

The facts here mentioned may appear to some of a most trivial, perhaps absurdly trivial, character, but to me they presented a very interesting problem, and one moreover which could not be solved by a wave of the hand. They also supplied a very pregnant illustration of the fact that even the commonest birds we know do at times (and perhaps more frequently than we suspect) exhibit the most marked variation from their normal habits and type, and that although one may have seen the same thing in Nature a hundred times over, it may be well worth looking at for the hundred and first time, and may then be found to present features or points of interest entirely new. It is to possibilities of this kind that bird-watching and bird's-nesting, in common with so many other pursuits, owe no small portion of their pleasures and their charm.

In conclusion, I desire to cordially thank all my correspondents for the valuable assistance their notes have given to me.

The list of summer visitors with dates of arrival, etc., is as follows :—

Species.	Locality.	Date.	Observer.
Nightingale (*Daulias luscinia*)	St. Albans	April 10	H. Lewis.
	Elstree	,, 21	E. P. Thompson.
	Hatfield	,, 22	T. Brown.
	Hitchin	,, 25	A. W. Dawson.
	Watford	,, 27	Mrs. Bishop.
	,, (Rousebarn Lane)	,, 27	W. Bickerton.
	Harpenden	,, 28	J. J. Willis.
	Harefield	,, 28	G. E. Eland.
	Berkhamsted	,, 29	Mrs. E. Mawley.
	Sawbridgeworth	,, 30	H. S. Rivers.
Greater Whitethroat (*Silvia cinerea*)	Brockley Mill	May 1	E. P. Thompson.
Blackcap (*Silvia atricapilla*)	Bushey Heath	April 25	P. J. Barraud.
Chiffchaff (*Phylloscopus rufus*)	Bushey Heath	Mar. 22	P. J. Barraud.
	Loudwater	April 2	W. Bickerton.
	St. Albans	,, 3	H. Lewis.
(Latest date)	Hitchin	Oct. 4	A. H. Foster.
Willow-Wren (*Phylloscopus trochilus*)	Bushey Heath	April 8	P. J. Barraud.

Species.	Locality.	Date.	Observer.
Sedge-Warbler (*Acrocephalus phragmitis*)	Cassiobury Park	May 2	W. Bickerton.
Tree-Pipit (*Anthus trivialis*)	Bushey Heath	April 20	P. J. Barraud.
Spotted Flycatcher (*Muscicapa grisola*)	Sawbridgeworth	May 5	H. S. Rivers.
	Odsey	,, 10	H. G. Fordham.
	Hatfield	,, 23	T. Brown.
	Broxbourne	June 2	Rev. H. P. Waller.
Swallow (*Hirundo rustica*)	Sawbridgeworth	April 10	H. S. Rivers.
	Bushey Heath	,, 15	P. J. Barraud.
	Broxbourne	,, 16	Rev. H. P. Waller.
	St. Albans	,, 17	H. Lewis.
	Berkhamsted	,, 20	Mrs. E. Mawley.
	Odsey	,, 25	H. G. Fordham.
	Harefield	,, 26	G. E. Eland.
	Harpenden	,, 27	J. J. Willis.
	Hatfield	,, 27	T. Brown.
	Watford	,, 27	Mrs. Bishop.
	,, (Weetwood)	,, 27	Mrs. Hopkinson.
	Hitchin	,, 30	A. W. Dawson.
(Last seen)	Berkhamsted	Oct. 10	Mrs. E. Mawley.
	Watford	,, 12	Mrs. Hopkinson.
	Harefield	,, 17	G. E. Eland.
	Odsey	,, 22	H. G. Fordham.
	Broxbourne	,, 29	Rev. H. P. Waller.
	Sawbridgeworth	,, 30	H. S. Rivers.
House-Martin (*Chelidon urbica*)	Elstree	May 6	E. P. Thompson.
Swift (*Cypselus apus*)	Watford	,, 13	W. Bickerton.
Wryneck (*Iÿnx torquilla*)	St. Albans	April 12	H. Lewis.
	Bushey Heath	,, 12	P. J. Barraud.
Cuckoo (*Cuculus canorus*)	Berkhamsted	,, 20	Mrs. E. Mawley.
	St. Albans	,, 20	H. Lewis.
	Bushey Heath	,, 21	P. J. Barraud.
	Hatfield	,, 21	T. Brown.
	Sawbridgeworth	,, 25	H. S. Rivers.
	Harpenden	,, 26	J. J. Willis.
	Watford	,, 26	Mrs. Hopkinson.
	Harefield	,, 27	G. E. Eland.
	Watford	,, 28	Mrs. Bishop.
	Broxbourne	,, 28	Rev. H. P. Waller.
	Odsey	,, 29	H. G. Fordham.
	Hitchin	,, 30	A. W. Dawson.
	Elstree	May 1	E. P. Thompson.

XVIII.

NOTES ON SOME HERTFORDSHIRE MAMMALIA.

By A. E. Gibbs, F.L.S., F.R.H.S.

Read at Watford, 3rd February, 1904.

Albinism.

Albino specimens of two of our common Insectivora have recently been added to the collections at the County Museum.

The cream-coloured mole (*Talpa europæa*) was killed in Rousebarn Lane, Watford, in the year 1901. The occurrence of albinism in this species is apparently not unusual, for in 1883 the late Dr. Brett reported to this Society the finding of thirty moles of a white or cream colour in about half an acre of oats near Watford.* There have been one or two subsequent records of the appearance of this variety in the neighbourhood, Mr. Vaughan Roberts exhibiting some specimens taken at Ley Farm, between Watford and St. Albans, at a meeting of this Society held on the 11th of December, 1891.† Again, in June last Mr. T. Fowell Buxton, J.P., of Easneye, Ware, informed me that a mole, nearly white, with the under-fur of a light pink colour, was killed on the Waters Place Farm, near Ware, on Friday the 19th of that month.

The second example of albinism to which I have to draw your attention is a greater rarity. The beautiful little specimen of the common shrew (*Sorex auraneus*) was taken in July last under a haycock on Symond's Hyde Farm, by Mr. B. L. Braithwaite, and was sent to the County Museum by Mr. T. Brown, a careful observer, to whom we are indebted for many gifts. It was captured alive, and was kept for a few days in a cage and fed on worms. It had a most voracious appetite, and apparently killed itself by overfeeding. Mr. Brown informs me that the last time it was seen to feed it devoured a whole worm about 4 inches long and as thick as a lead pencil. The next morning it was found dead. Mr. Crossman, who formerly acted as one of our Recorders, in an article on "Hertfordshire Mammalia" in the 'Victoria County History,'‡ records the fact that in 1893 Mr. Henry Lewis, of St. Albans, obtained two white specimens of the common shrew near that city, and remarks that "this is a most unusual occurrence, as albinism is seldom found in this species." I believe Mr. Lewis's specimens are now at the Natural History Museum, South Kensington.

The Rodents.

Three small rodents, viz., the dormouse (*Muscardinus avellanarius*), the wood-mouse (*Mus sylvaticus*), and the bank-vole (*Microtus glareolus*), are to be found commonly in the meadows attached to my house, the two latter having been especially abundant during the Autumn of 1903.

* 'Trans. Herts Nat. Hist. Soc.,' Vol. II, p. liv.
† Ibid., Vol. VII, p. 43.
‡ 'Victoria History of Hertfordshire,' vol. i, p. 218.

The bank or red vole is very partial to sheltered banks covered with ivy and other vegetation, and its runs can be traced in the meadow-grass. It builds a loosely-constructed nest amongst herbage, the one exhibited having been found in some nettles, slightly raised above the surface of the ground, and I have had it mounted for the Museum. The voles themselves were mostly taken in an ordinary penny trap.

The common vole (*Microtus agrestis*), of which I have also brought specimens for comparison, is nearly allied to the bank-vole, from which it may be distinguished by its shorter tail and its browner colour. We have specimens at the Museum from St. Albans and Symond's Hyde. This species is a most destructive one, and as it multiplies at a very rapid rate when its natural enemies the hawks, owls, weasels, and other birds and beasts of prey are exterminated, it sometimes does an immense amount of damage to growing crops and young trees. Its best friend is consequently said to be the keeper who kills those predatory creatures.

The wood-mouse (*Mus sylvaticus*) is another species which was common in my grounds in 1903, and of which we trapped a number of specimens. I exhibit a group which Mr. Bullen, our taxidermist, has cleverly set up for the Museum.

Besides the albino specimen of the common shrew to which I have already referred, I have brought for inspection Hertfordshire specimens of our two other shrews, the water-shrew (*Crossopus fodiens*) and the lesser shrew (*Sorex minutus*), the latter a not very common animal, I think. It has the distinction of being our smallest British mammal.

Of the 28 species of Mammalia which have been recorded as occurring in Hertfordshire, my own grounds, only four or five acres in extent, have yielded eleven, viz. :—

Long-eared Bat (*Plecotus auritus*).
Mole (*Talpa europæa*).
Weasel (*Mustela vulgaris*).
Squirrel (*Sciurus vulgaris*).
Dormouse (*Muscardinus avellanarius*).
Wood-Mouse (*Mus sylvaticus*).
House-Mouse (*M. musculus*).
Brown-Rat (*M. decumanus*).
Water-Vole (*Arvicola amphibia*).
Bank-Vole (*A. agrestis*).
Rabbit (*Lepus cuniculus*).

XIX.

THE GRAVELS OF HERTFORDSHIRE.

By A. E. Salter, D.Sc., F.G.S.

(Communicated by J. Hopkinson, F.L.S., F.G.S.)

Read at Watford, 2nd November, 1904.

Introduction.

The superficial deposits of Hertfordshire have been made the subject of study by many geologists, and papers relating to them by Professor T. McKenny Hughes,* Searles V. Wood, jun.,† Sir Joseph Prestwich,‡ J. V. Elsden,‖ H. W. Monckton and R. S. Herries,§ Dr. A. Irving,¶ Dr. T. E. Lones,** H. B. Woodward,†† and the author,‡‡ may be found either in your own 'Transactions' or in those of other societies.

Most of these deal with parts of the County only. It is proposed in this communication to treat of the whole of the superficial deposits of the County, and to deal somewhat with that vexed question, their mode of origin.

To account for these deposits one school of geologists would invoke the aid of marine conditions, while another would discard this utterly and refer their production to the action of ice-sheets or other glacial phenomena.

It has always appeared to me that, before invoking the aid of these all-powerful agents upon what is often very meagre or untrustworthy evidence, it should first be ascertained to what extent many of these deposits may be due to the ordinary agents of denudation, acting perhaps at times with greater or less intensity than in the present day. Having eliminated all such deposits as may reasonably be referred to this cause, we should then perhaps be in a better position to gauge the truth or falsity of the hypotheses

* "On the two Plains of Hertfordshire and their Gravels," 'Quart. Journ. Geol. Soc.,' vol. xxiv, p. 283.

† "On the Pebble Beds of Middlesex, Essex, and Herts," 'Quart. Journ. Geol. Soc.,' vol. xxiv, p. 464.

‡ "On the Relation of the Westleton Shingle to the other Pre-Glacial Drifts in the Thames Basin," 'Quart. Journ. Geol. Soc.,' vol. xlvi, p. 155.

‖ "The Post-Tertiary Deposits of Hertfordshire," 'Trans. Herts Nat. Hist. Soc.,' Vol I, p. 103.

§ "On some Hill Gravels north of the Thames," 'Proc. Geol. Assoc.,' vol. xii, p. 108.

¶ "On the Geology of the Stort Valley," 'Proc. Geol. Assoc.,' vol. xv, p. 224; see also *loc. cit.*, p. 193.

** "The Gravels, Sands, Clays, and Loams of Western Hertfordshire," 'Trans. Herts Nat. Hist. Soc.,' Vol. X, p. 153.

†† "On Disturbances in the Chalk near Royston," 'Quart. Journ. Geol. Soc.,' vol. lix, p. 362; see also 'Proc. Geol. Assoc.,' vol. xviii, p. 167.

‡‡ "'Pebbly Gravel' from Goring Gap to the Norfolk Coast," 'Proc. Geol. Assoc.,' vol. xiv, p. 389; see also vol. xv, p. 274.

which have been advanced, and may even be able in some districts to show that they are superfluous and unnecessary, or that others of a totally different character are more feasible.

If a contoured map, or, better still, a large raised model of the country on the north side of the basin of the Lower Thames, be examined, this district will be found to be made up of the following parts:—

1. A long dip-slope down which many streams have formed valleys. One valley only,* that of the Thames, extends beyond this dip-slope, but the presence of beheaded valleys at or near the sources of some of the smaller streams points in such cases to a former extension northwards.
2. A steep escarpment to the north. This varies in height from a little over 800 ft. O.D. in the west to 519 ft. O.D. at Reed in the N.E. of Hertfordshire. It is broken at Goring Gap, through which the Thames flows at about 190 ft. O.D.; at the Stevenage Gap, the lowest point of which is just above 300 ft. O.D.; and further east by the Bishop's Stortford Gap, the lowest point of which at Elsenham is about 300 ft. O.D. Neither of the two last-mentioned gaps has fluviatile connection now with the Midlands. The gravels, however, which are found associated with them show that such a connection formerly existed.
3. A large extent of comparatively low ground north of the escarpment across which a few short anti-dip (obsequent) streams flow northward into the larger longitudinal streams which flow west into the Thames and east into the Ouse.
4. A region of higher ground lying south of the main slope. This is now much cut up by denudation. It rises to just over 500 ft. O.D. on Stanmore Common. The highest points are capped by gravel, to which circumstance their preservation is due.† Whether this feature may be partly due to earth-movement is a question needing investigation. It is significant, however, that in the road leading to Mimmshall Wood, N.E. of South Mimms, the Woolwich and Reading Beds are to be seen resting on the Chalk just below 400 ft. O.D., whereas they are found at much lower heights a little to the N.E. This may point to a fault or a gentle fold in that neighbourhood.
5. A belt of lower ground lying between 1 and 4 partly occupied by the Colne and Lea Valleys but continued eastward into Essex.

All these features are well developed in Hertfordshire, and have an important bearing upon the interpretation of the mode of origin of its superficial deposits.

* It may be noted that the Lea rises just beyond the Chalk escarpment on Lower Cretaceous strata.

† A. E. Salter, "Excursion to Stanmore," 'Proc. Geol. Assoc.,' vol. xvii, p. 175. C. Reid, in 'Record of Progress of the Geological Survey,' 1899, p. 140.

The "Drift Series" at Goring Gap.

Although Goring Gap is some distance from Hertfordshire, it plays an important part in the present inquiry. As before stated, it is the only means, at present, of fluviatile connection between the country north of the escarpment and the Lower Thames basin. As a consequence we get in its vicinity numerous superficial deposits forming a more or less complete "Drift Series." The absence, also, of boulder-clay renders their interpretation much simpler than that of deposits further east. Briefly the deposits may be divided into three classes:

1. A high-level drift consisting mainly of flint-pebbles and other débris of the Lower Tertiary strata, with which is mixed a variable quantity of non-local material, such as quartz-pebbles and other materials derived from a Palæozoic source.
2. The drift with Bunter débris which comes in below that just described, and reaches down to
3. The three terraces of modern river-drift, containing Palæolithic implements, remains of Pleistocene Mammalia, etc.

It must not be supposed, however, that there is any sharp line of demarcation between these, but deposits of an intermediate kind are found, and slipping may occur. In fact, they shade off one into the other in just such a manner as is required by a fluviatile hypothesis of their origin.

The upper members of the Goring Gap "Drift Series" can be traced across South Bucks, Herts, and East Anglia, while the lower members follow the direction of the present valley.

The High-level Superficial Deposits.

On the higher parts of the Chalk slope the superficial deposits are of subaërial origin, and consist of the well-known Clay-with-flints and débris from the Lower Tertiary beds, often including large sarsen-stones and blocks of Hertfordshire Conglomerate, which at one time occupied larger areas than they do now, and protected the soluble Chalk strata beneath them. Pits may be seen at Caddington (Beds), Hyde Heath west of Chesham (Bucks),* between Buntingford and Hare Street (East Herts), and in the cuttings of the Metropolitan Railway at Chalfont Road Station and further north.

The Tertiary outliers which remain are usually capped by gravel similar to that found at high levels near Goring Gap. This gravel has protected and preserved the strata below them, while much larger tracts, not so protected, have succumbed to the action of denuding agents.

These deposits are often disturbed owing to the piping of the chalk below and to rootlets and burrowing animals descending

* Upfield Green and H. B. Woodward, "Excursion to Wendover," 'Proc. Geol. Assoc.,' vol. xii, p. 340.

from above. Their constituents are also usually much weathered, the whole pointing to their having been surface-features for a very long time. Sections may be seen at Coles Hill near Amersham, and Tyler's Hill near Chesham, Bucks;* and at Sarratt, Chipperfield, Abbot's Langley (at the back of Mr. J. S. Burrage's house in Abbot's Road), Bedmond (near the school on the road to King's Langley), Bennett's End, Stanmore Common, Shenley, Arkley, Potter's Bar, Bell Bar,† Mimmshall Wood near South Mimms, Bayford, Hertford Heath, etc., Herts.

Of the non-local constituents of these deposits may be mentioned the following:—Quartz-pebbles of various kinds, e.g. white, pink, and translucent; small blocks of rough quartz, dark chert, some with intricate quartz-veining, jasper, and small pieces of Carboniferous chert showing crinoid stems. In places where the level approximates to that of the succeeding set of deposits a few Bunter quartzites, and more rarely pieces of rhyolite, much decayed as a rule, make their appearance. An important substance is often found in the more southerly deposits, as at Hampstead Heath, High Barnet, Newgate Street, and Brickendon Green, viz., Lower Greensand chert from the Hythe Beds of the Wealden area. As this substance is not found in the Lower Greensand of the Midlands and does not occur in the gravels in the northern and central parts of the county, it is reasonable to suppose that, at the time these deposits were formed, streams from the Wealden area entered this district. This substance also occurs plentifully in the high-level gravels of Essex.

Similar deposits are found in the vicinity of the Stevenage Gap at corresponding levels, of which sections may be seen at Ayot brickyard (beneath a drift-clay),‡ Potter's Heath, Harmer Green, Sacombe Green, Collier's End, etc. No Lower Greensand chert occurs in them, and their constituents are of a rather more varied character than those already mentioned.‖

It is evident from the above that in order to understand the origin of these high-level drifts it is necessary to temporarily banish from our minds the present configuration of this part of the country. The region of higher ground lying south of the main slope, described in the Introduction to this paper, had three main lines of drainage converging towards it from the west, north, and south respectively, which united here to form an easterly-

* Upfield Green, "Excursion to Boxmoor," 'Proc. Geol. Assoc.,' vol. xvi, p. 501; "Excursion to Chesham and Cowcroft," *op. cit.*, vol. xv, p. 87; and "Excursion to Cowcroft," *op. cit.*, vol. xvii, p. 370. W. P. D. Stebbing, "Excursion to Penn and Coleshill, Bucks," *op. cit.*, vol. xv, p. 311.

† A. E. Salter, "Excursion to Potter's Bar and Hatfield," 'Proc. Geol. Assoc.,' vol. xiv, p. 420.

‡ J. Hopkinson and A. E. Salter, "Excursion to Ayot Green and Hatfield Hyde," 'Proc. Geol. Assoc.,' vol. xv, p. 308; see also *op. cit.*, vol. xvii, p. 396. H. W. Monckton, "On a Section of the Westleton Beds at Ayot Brickfield," 'Geol. Mag.,' 1899, p. 59.

‖ For a fuller account of these deposits see the author's paper "On the Superficial Deposits of Central and parts of Southern England," 'Proc. Geol. Assoc.,' vol. xix, p. 1.

flowing stream, the gravels deposited by which can still be traced across the northern part of Central Essex and the south of Suffolk.

The Gravels containing Triassic Débris occurring at intermediate heights.

Referring once more to the "Drift Series" connected with the Goring Gap, it may be noticed that the middle part of that series consists of gravel patches made up chiefly of flint, but containing also a fair proportion of quartzite pebbles, etc., from the Bunter pebble-beds, materials derived from the older gravels, and pieces of an igneous rock of a rhyolitic character. This is of a greenish colour with numerous felspar phenocrysts, and often shows spherulitic and flow-structure well. Rarely also pieces of a greenish ash occur. Jurassic material, basalt, and granite are absent.

These gravels may be traced in a direction roughly parallel to, and occupying heights lower than the previous set of deposits, across Bucks, at the top of the hill leading from Loudwater to Beaconsfield, at Gerrard's Cross, and at Gravel Hill north of Chalfont St. Peter, where sections may be seen; and in Herts, on the hill west of Chorley Wood Station and in a road-section east of the same, at Chenies, at Bedmond, where there is a section 20 ft. deep to the east of the village near the pond, north and south of St. Albans, on Woodcock Hill near Rickmansworth, and at Kemp Row west of Radlett. There are also some good sections at Twyford south of Bishop's Stortford, and near Hockerill, containing Triassic débris and supra-Cretaceous material only. These are opposite the Bishop's Stortford Gap, but it is quite possible that some of the material was derived from the west. They also occur in the same relative position across Essex, as at Hatfield Heath, Hunsdon, and Stanstead Bury.

The line of drainage through the Stevenage Gap was still in existence, but there does not appear to be any evidence of connection with the Wealden area. Sections may be seen in Holter s pits just north of Datchworth Church, in Capt. Blake's and in Smart's pits at Woolmer Green, near Codicote; and the pipes in the Chalk seen in the railway-cutting north of Knebworth contain Bunter quartzites.

These gravels are much more extensive and thicker than those described in the previous section; they are usually well stratified, and often show much current-bedded sand.

The presence of large quantities of partially-rounded flint shows that much denudation of the Chalk was going on owing to the erosion of the protecting covering of Lower Tertiary beds.

The Northern Drift Clays and the Gravels and Boulders associated with them.

It is not proposed to treat of these deposits fully on the present occasion, but only in so far as they affect the other deposits herein described.

Up to the present we have been dealing with deposits made up mainly of local material with a fair amount derived from the Triassic or older strata, the only igneous rocks met with being of a rhyolitic type.

On the highest parts of the Chalk slope east of the Dunstable Downs, excluding Warden Hill, a totally different class of deposit is found. It is largely made up of clay, but contains numerous fragments of rocks derived from a distance, which in places form beds of gravel. They can be studied at Great Offley 526 ft. O.D. and at Gravel Hill 500 ft. O.D. on the top of the escarpment south of Hexton. At West Mill just below 300 ft. O.D., south of Buntingford, there is a deposit 10 ft. thick containing much non-local material probably derived from higher deposits. At that station the deposit is stratified in places, and is made up of flints, Chalk pebbles, gryphæas, belemnites, large and small, coprolites from the Cambridge Greensand, Red Chalk, hard chalk, sandstones, quartzites, Carboniferous Limestone, Carboniferous chert, etc. A block of basalt 12 ins. by 8 ins. was seen *in sitú*, and a sandstone boulder 12 ins. by 12 ins. Close by, near the Fever Hospital (Mr. R. Shepheard's pits), and nearer Aspenden, similar deposits may be seen.

At Offley, in a pit 10 ft. deep at the back of Mr. Charles Forster's house near the windmill, many erratics were found during a recent visit, including rhomben porphyry, two or three varieties of basalt, Carboniferous Limestone, *Gryphæa incurva* and *dilatata*, large belemnites and other Jurassic débris, quartz-pebbles, red and other coloured quartzites, and dark chert. Flints were numerous and pebbles of hard chalk were present. The patch on Gravel Hill was of a similar character, but I did not see any igneous rocks.

Associated with these deposits are many large boulders of igneous and other rocks. These may be seen by the roadside, etc., at the following places:—Upper Sundon and Streatley, Beds; Wallington near Church, Cumberlow Green, Sundon, Kelshall, Roe Green, between Reed and Barkway, and West Mill.* Deposits at lower levels show by their constituents that they have derived their non-local material from the higher gravels. The large gravel-pits near Leagrave and Limbury, north of Luton, Beds, at 400 ft. O.D., contain much material derived from higher deposits like those of Offley, etc.† At Hatfield Hyde two boulder-clays may be seen separated by a bed of gravel.‡

As the gravel deposits described in 2 and 3 are free from the non local material peculiar to the deposits here described, it seems reasonable to suppose that these latter were deposited subsequently

* H. G. Fordham, "Notes on Boulders and Boulder Clay in North Hertfordshire," 'Trans. Herts Nat. Hist. Soc.,' Vol. III, p. 33; J. V. Elsden, "On the Microscopic Structure of Boulders found in the North of Hertfordshire," *loc. cit.*, p. 47.

† Cf. also "Geology of South Beds," J. Saunders, 'Geol. Mag.,' 1890, p. 122.

‡ Cf. 'Trans. Herts Nat. Hist. Soc.,' Vol. X, p. xxviii, and 'Proc. Geol. Assoc.,' vol. xv, p. 308.

to them. The occurrence of these deposits at the time when the drainage changed from its former west to east direction to its present one is very significant, and, when viewed together with the former southerly fluviatile connection with the Weald, strongly suggests the extreme probability that *one* cause for the facts observed is to be found in a modification or accentuation of the synclinal basin of the Lower Thames Valley.

The Gravels on the Dip-slope of the Chalk, etc., connected with the present River-system.

The lower part of the "Drift Series" at Goring Gap forms three terraces, and can be traced along the sides of the present Thames through South Bucks, North Surrey, Middlesex, Southern Essex, and Northern Kent. They differ from the higher gravels not only in general direction and level, but also in containing the remains of Pleistocene Mammalia, Palæolithic implements, and fresh-water shells. The Colne and the Lea, by cutting back their valleys, have captured between them the drainage of Hertfordshire. The remains of extinct Mammalia, Palæolithic implements, etc., found in this part of Hertfordshire, come from these gravels.* A palæolith was obtained recently by the author from the gravel-pit on the left of the road from the station leading to Welwyn, and is now in the County Museum at St. Albans.†

The contents of these gravels depend upon the materials found in their drainage areas, and much has been derived from the older gravels already described. Sections may be seen near Croxley Green east of Rickmansworth, where there are two large pits, at King's Langley, Watford, The Noke, Burston, Sutton Colney, Wheathampstead, Welwyn, Digswell, two miles from Watton on the Walkern Road (left), Hertingfordbury,‡ Amwell, Ware, Hoddesdon, Rye House, Broxbourne, and Theobalds, near Old Temple Bar; at Latton and Netteswell just over the Herts border in Essex, Castle Anstey south of Barkway, Rye Street, Bishop's Stortford, and north of Much Hadham. Jurassic material occurs in them when the area drained by them contains the drift-clays, etc., described in section 4. These are mainly found in the eastern part of the county. In the western part Jurassic débris, basalt, granite, etc., do not occur, so far as I have been able to ascertain.

The fluviatile connection with the Midlands by means of the Stevenage Gap ceased owing to the cutting back of the Chalk escarpment by denudation, assisted probably by the earth-movements referred to in the last section.

* Cf. 'Man the Primæval Savage,' by Worthington G. Smith, and the following by the same author:—"Primæval Man in the Valley of the Lea," 'Essex Nat.,' vol. i, pp. 36, 83, 125; 'Nature,' vol. xxiii, p. 604; vol. lii, p. 222; vol. lix, p. 506; vol. lx, p. 390; also 'A Guide to the Antiquities of the Stone Age in the British Museum, Bloomsbury.'

† The Rev. H. Kendall, formerly of Hatfield Hyde, informs me that he also has obtained two, which he has sent to the British Museum (Bloomsbury).

‡ A. E. Salter, "Excursion to Hertingfordbury, Bayford, and Brickendon Green," 'Proc. Geol. Assoc.,' vol. xvi, p. 447.

The Gravels connected with the Anti-dip (obsequent) Streams flowing northward from the Escarpment.

Several small streams occur north of the escarpment, but the Hiz is the only one we need consider.

There is much gravel around Hitchin, consisting mainly of flint and such non-local material as has found its way down from the higher parts of the Chalk slope near the escarpment.* Pits occur near the Union, and at Highbury, Hitchin. At Clay Bush Hill near Ashwell is a deposit of similar derivation. As before mentioned, the gravel-deposit at 500 ft. O.D. on Gravel Hill is close to the edge of the escarpment, and will, as denudation proceeds, descend to lower levels, and help in the formation of more recent deposits. In this way the non-local material of this district has been derived in former times. The late age of the gravels near Hitchin is shown also by the presence of Palæolithic implements, etc., as described by Mr. Clement Reid, F.R.S.†

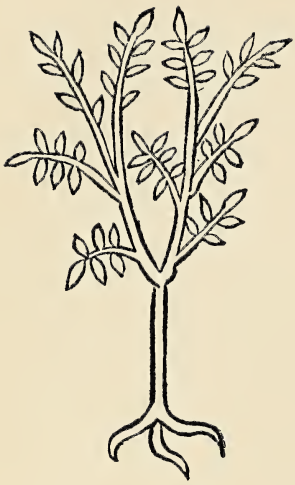
Conclusions.

It will be seen from the foregoing remarks that the origin of the gravel-beds of Hertfordshire can be explained on a hypothesis giving great prominence to subaërial and fluviatile agencies, but that it is necessary to assume that the synclinal basin of the Thames Valley has undergone modification or accentuation. The disposition of the gravels shows that this was as a rule a slow process, although there appears to be some evidence for supposing that the initiation of the present system of drainage may have been brought about more rapidly. The most potent factor, as seen by the heights of the earlier gravel-beds, has, however, been the slow but ceaseless action of the ordinary agents of denudation acting through a long period of time.‡

* W. Hill, "Excursion to Hitchin," 'Proc. Geol. Assoc.,' vol. xiv, p. 415.

† Cf. "The Palæolithic Deposits at Hitchin and their relation to the Glacial Epoch," 'Geol. Mag.,' 1897, p. 228; 'Proc. Roy. Soc.,' vol. xli, p. 40; 'Trans. Herts Nat. Hist. Soc.,' Vol. X, p. 14.

‡ There are numerous references to Hertfordshire gravels in which Palæolithic implements occur in 'Ancient Stone Implements' by Sir John Evans. See also his Anniversary Address (1895) on "The Stone Age in Hertfordshire," in 'Trans. Herts Nat. Hist. Soc.,' Vol. VIII, pp. 169–187.—Ed.



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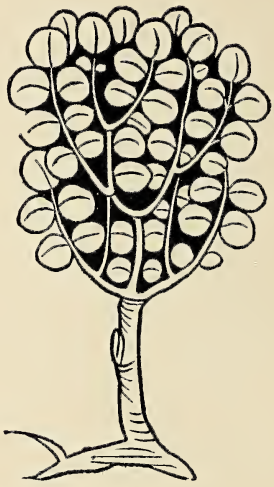

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Botanic Illustration, 1484–1542.

XX.

ADDRESS.

THE HISTORY OF BOTANIC ILLUSTRATION.

By the President, B. Daydon Jackson, F.L.S., General Secretary of the Linnean Society.

Delivered at the Anniversary Meeting at Watford, 8th March, 1905.

PLATES I–III.

Ladies and Gentlemen,—

At our last Anniversary Meeting I had the honour to offer some remarks on a topic of local interest—the labours of some Hertfordshire botanists. This evening I purpose asking your attention to a matter less restricted in space and time, namely, the history of botanic illustration from the fifteenth to the twentieth centuries.

As an indispensable preliminary I must define the sense in which I use the term illustration. By it I mean a representation in printing-ink or some similar medium, capable of identic reproduction in considerable numbers. Thus I am excluding all sketches or drawings which need to be copied by hand, and all purely photographic prints. Another limitation is the exclusion of colour; it would lead me too far for this Address, and furthermore it does not readily lend itself for use in the lantern.

We may consider illustration thus defined to consist of three main methods:

(1) When the design projects from the surface, and the ink is applied only to the elevations,

(2) When the design is cut into the surface, and the ink remains only in the depressions, and

(3) When the surface is practically level, the design being reproduced by chemical action, as in lithography.

1. Surface Design (Wood-engraving).— This method was the first to be employed in illustration, and the early forms of it are well-known under the name of block-books, in which the drawing and the legend are printed from the selfsame block, as in Chinese printing at the present day. The introduction of movable type caused the text not only to be extended to giving the whole of treatises, but also confined the woodcuts to the ornamental part of illustration. As the art and mystery of printing became diffused, and was no longer confined to copying the Bible, books of devotion, and the classical writers, it became applied to works of more homely utility, such as medical treatises. It was in this way that the works of Dioscorides and the Arab physicians were

produced, at first in selections, afterwards in full. The carefully-written manuscripts which supplied the copy for the early printers were in many cases adorned with pen drawings of the objects described, and in this way the compilers of the first commentaries on medicine followed the lead of their predecessors the copyists, and the drawings were copied on wood and inserted in the text. They were crude and rough, as might be expected from their history, owing to their having been copied in succession one after another, so that in many cases the object has become wholly unrecognizable. The first lantern-slide (Pl. I, fig. 1) is taken from an edition of a work termed, from the first word in its title, 'Herbarius,' of 1484, which was printed in that year at Mainz: it represents the spurge-laurel, *Daphne Laureola*, but, as you see, it might well serve for many plants. The second slide is drawn from the same volume and is entitled "Cucumer," a gourd. Another work of similar character was the 'Ortus sanitatis,' which had an extraordinary vogue, and, besides being reprinted in its original Latin many times, was also translated into most of the European languages. I have here two cuts selected from an undated edition, issued in all probability about the same date as the last book I mentioned: here you see the beech-tree (Pl. I, fig. 2) as represented by a mediæval scribe, and next a saxifrage, which is certainly *Asplenium Ceterach*, Willd.

But these compilations from old authors did not long content the readers of those early times. Men began to examine plants in the field, and to compare them with the records in the books they possessed: a critical spirit began to stir, and the new wine could no longer be contained in the old bottles. One of the first of the new school was Otto Brunfels, from whose 'Herbarium vivæ eicones' in 1530 I show you the next slide,—henbane (Pl. I, fig. 3), which, as you see, is not only easy to recognize, but is in a distinctly better style of art. In 1542 appeared a book which has always been a favourite of mine, the 'De historia stirpium commentarii imagines,' published at Basel, with admirable whole-page cuts, such as that of *Salvia* here shown (Pl. I, fig. 4). Another fact about the author of this work, Leonard Fuchs, after whom the genus *Fuchsia* is named, is his evident desire to give due credit to the draughtsmen and engraver of his book, for at the end he not only gives their names, but also their portraits, an amiable trait of his character which is difficult to parallel, not merely amongst contemporary authors, but for some ages later. The next example I have to show, *Clematis* (Pl. II, fig. 1), is taken from the herbal of Rembert Dodoens, of Mechlin, issued in 1583, and used in many

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Botanic Illustration, 1583–1727.

other herbals, including that of our own Gerard, in all of its three forms.* You will notice how the shape of the block has been followed in bending the plant to take up as much of the surface as may be. The next slide is also from the same author; it is the poppy (Pl. II, fig. 2). Of a finer, bolder style is a series of cuts brought out in 1565 and 1583 by the Venetian printers, the Valgrisi, as represented on the screen by *Helianthemum variabile.*

The last specimen of the early wood-blocks which I have to display this evening (Pl. II, fig. 3) is that now shown from our Parkinson, published in 1629, reissued in 1656 from the same blocks, and facsimiled in 1904; notice the parsimony with which every inch of the block has been utilized. I used to wonder how these large surfaces could be produced by the old printers, but a few years ago some old blocks which had been cut in Sweden towards the end of the seventeenth century came under my notice. I then saw that in place of using the transverse surface, and building up large blocks by keying them together, the blocks consisted of longitudinal pieces of pear-wood, frequently brought up type-high by underlays of deal.

2. Copper Plates.—The last specimen I showed to you was issued in 1629, but before that year other methods of engraving had begun to make their way. Instead of leaving lines to form the printing-surface, people took to incising lines, which, when filled with ink and the superfluous ink cleaned off, produced the requisite design. Here we have an etching of a *Sideritis* by Fabio Colonna, the border being separately printed in letterpress, but you see that the lines have been bitten in at one operation, and the ground has been prepared with charcoal, giving a delicate tint. This slide has been taken from the author's 'Ekphrasis,' 1616, but his earlier 'Phytobasanos' shows work of similar character.

Another sample, this time from the 'Specimen' by Reneaulme, a Frenchman, is somewhat rougher, but true and characteristic of the plant shown, *Dianthus plumarius*, the sweet-william of gardens.

* This particular block was used in the following works:—
Dodoens, 'Pemptades,' 1583, 1616.
Lobel, 'Historia,' 1576, and the Flemish version, 1581.
—— 'Icones,' 1581 and 1591.
Clusius, 'Historia,' 1601.
Gerard, 'Herball,' ed. Johnson, 1633 and 1636.
It was closely copied for
Gerard, 'Herball,' 1597.
Parkinson, 'Theatrum,' 1640.
Less accurately copied in
Bauhin (J.), 'Historia,' 1651.
Chabræus, 'Sciagraphia,' 1666 and 1677.
Petiver (J.), 'Herbarium Britannicum.'

A much later instance is that of a plate by Dillenius, also etched by the author; it is from his 'Hortus Elthamensis,' 1732, and represents the China aster, *Aster chinensis*. Another by Alpini (1592) of the plant now called *Stæhelina arborescens* is shown to display the art of producing relief in the printing, giving much the same effect as the modern method known as *retroussage*, the ink being made to overflow in some slight degree over the lines after the ground has been cleaned off. Etchers frequently use the needle to scratch lines on the metal, which gives a more delicate result than by biting in, but in this example we have an entire design in dry-point by Dr. John Hill, who constantly employed this method. The needle thus used creates a burr on the metal, just sufficient to hold a small amount of ink, but in old times, before plates were steeled, the act of cleaning off rapidly wore down the burr, hence you can perceive the lines becoming indistinct on the plate.

The difficulty of properly biting and gradating the drawing led to the employment of trained engravers: here is a beautiful instance of such work in Vaillant's folio on the plants about Paris, from a drawing by Aubriet, 1727 (Pl. II, fig. 4); the next is bolder, by Ehret, of a *Piper* in Linnæus's 'Hortus Cliffortianus' (1737). This, a *Mentha* (Pl. III, fig. 1), in Sole's well-known 'Menthæ Britannicæ,' shows an attempt to compete with colour by expressing as much as possible in black and white. In passing I may remark that when plates are intended to be finished by colouring, little more than an outline is printed.

Other methods have been tried: a softer style is attained as in the slide now shown, a *Crinum*, in mezzotint, employed by Professor John Martyn; in this process the surface is impressed by a special tool, which creates the dark velvety ground which has then to be scraped and burnished up to the lights.

For a long period copper-plate printing had ousted woodcuts as methods of botanic illustration, but a new period set in with Thomas Bewick. This celebrated engraver on wood saw the true way to use wood, not by competing with copper, and pretending to imitate the single easy incision of the graver by a tedious operation in wood, but by transferring the war into the enemies' country, so to speak. He was the first to employ the white line and the flat black; and as the sample shown, henbane, in Thornton's 'Herbal' (1810), does but scant justice to Bewick's merits, I show his cut of the grasshopper warbler, to illustrate his use of the two methods just mentioned. The Japanese have long employed the flat black, as may be seen in this slide of *Podocarpus macrophylla*, taken

from the 'Kwa-wi' by YONAN-SI. My last example of modern wood-engraving is *Conium maculatum*, by FAGUET, in BAILLON's 'Dictionnaire.' You will notice the admirable production of aërial perspective, by which the nearer portions stand out from those in the background.

Now we arrive at the second period of copper-plate engraving, or, as more often, steel, to withstand the wearing down of the plate by the hand of the workman when cleaning it in printing. The method of stipple was used by P. J. REDOUTÉ, in a series of volumes which both for design and execution stand unapproached. The basis of his plates was stippling, a series of dots, and this plate was printed in colour by charging the various parts of the engraving with its appropriate pigment, the leaves green, the roots brown, the flowers yellow, etc., and then uniting the whole by high finish in water-colour. Of this I can give you no example; but the next slide will display quite as exquisite work in black and white, a plate from THURET's 'Etudes Phycologiques' (1878), in which you see that the full strength or colour of the alga is given, with extreme delicacy of the other parts; in fact, though the delicacy can be appreciated on the plate, the camera fails to do it justice, and I have therefore brought a second slide from another plate, for the delicate work alone.

3. LITHOGRAPHY.—The effect of the last slide leads naturally to the subject of lithography. Here we do not employ difference in level to bring out the design. The drawing is made on the smooth surface of a limestone from Solenhofen; the stone is either quite smooth, when a greasy ink is used, or a grain either coarse or fine is given by sand and water to receive lithographic chalk, so-called, a mixture of fat, soap, and lamp-black. The peculiarity of the stone used is, that while it absorbs either grease or water with ease, each repels the other, so that after treatment with weak acid the stone will receive ink on the design but not on the wetted parts of the stone. Lithographic printing therefore consists of inking and wetting the stone between each impression, the process depending on the impartiality of the stone for either, and the mutual repulsion of the ink and water. Here is an instance of a lithograph of *Cinchona* by J. N. FITCH, after a drawing by RIOCREUX which was intended to have been engraved in Paris, but this English draughtsman succeeded in producing the desired effect by lithography. For work of great minuteness the stone is often engraved, a ground being spread over the stone, and lines cut through the ground with a diamond.

Thus far we have had to do with illustration which depended

upon the craft of the draughtsman, who acted as intermediary and transcriber of the object; for the remainder of our review we have to deal with the direct reproduction of the objects by their own impress or photographic image upon the medium of printing.

The first attempt at process was that termed "Ectypa," in which the plant was inked, and so printed itself. On the screen are two examples of such, issued by D. H. Hoppe in his 'Botanisches Taschenbuch . . . auf das Jahr 1790'—an oak leaf and the entire plant of an asphodel, *Tofieldia anthericoides*. Although many hundreds were produced by Hoppe in one issue, the same specimen could not suffice for the whole impression, the pressure employed rapidly injuring the plant, so that a succession of specimens had to be used. A modern modification was the fine process devised by Henry Bradbury (d. 1860), known as "Nature Printing" (see Pl. III, fig. 2, two varieties of *Asplenium marinum*, from Bradbury's 'Nature-printed British Ferns'). His method consisted in placing the object to be copied between plates of steel and lead, and subjecting these to hydraulic pressure, the result being that the fern or seaweed was pressed into the lead. After the object was extracted, the lead plate was electrotyped, details and lettering were added to the new plate, and then impressions could be taken as from an ordinary plate. Usually the colour of the original object was copied in the prints. This admirable process had the drawback that the specimens were destroyed in the reproduction, and it could only be applied to such things as were able to withstand the heavy pressure.

Woodburytype, to be described at a later period, may be said to be the photographic outcome of Nature Printing, which did not survive the inventor as a practical process in this country. Nevertheless, a form of it modified by Auer, the superintendent of the Staats Druckerei in Vienna, was employed for a series of years by Baron Constantin von Ettingshausen to show the nervation of leaves; here is a slide (Pl. III, fig. 3) taken from his 'Fossile Flora von Sagor' in the Vienna 'Denkschriften' (1877); the leaves are printed in brown ink, but the numbers on the plates to the figures and the headings were printed subsequently by letterpress. In the text are inserted many small blocks of the venation, in white against a black background, also by some galvanoplastic copy of the original leaden mould.

The modern processes which have become part of our daily life have now to be specified. I will first take what is known as line-process, by which pen-drawings can be reproduced with excellent result. These modern processes depend entirely upon

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Botanic Illustration, 1798–1904.

the use of the camera, and frequently upon the electric arc-light, together with the action of bichromate salts upon colloids. The drawing is made in liquid Indian ink on card, and from it a dense negative is taken. It may surprise some to hear that for this the old wet collodion process is still used and preferred, for more than one reason; not only can a negative of satisfactory density be procured by its means, but as the negative has to be reversed the film may be stripped and turned over. There are other ways of achieving the reversal of the negative, such as placing a right-angled prism or mirror in front of the lens, or focussing through the plate exposed. The zinc to form the block is sensitized by either a solution of bitumen asphalt in benzol, or else a compound of white of egg, water, and bichromate of ammonia. This must be dried in the dark, as it becomes sensitive to light when dry. The prepared negative is then placed over it in a printing-frame, and a few minutes' exposure suffices to oxidise the albumen where the lines permit the passage of light; the surface is then rolled with printer's ink, dipped into a bath, and gently rubbed with cotton-wool; the unhardened albumen coming off with the ink, leaves the design on the plate in an insoluble condition. The back and sides of the plate are then varnished, and the first etching takes place, for a few minutes in very weak acid. Next the design is inked with a roller, and, while the ink is still wet, finely powdered resin or asphalt is dusted over the face of the plate, and then heated, so as to melt and thus cover the lines of the drawing with a protective film. In this way the etching proceeds, the plan detailed being many times repeated, till the plate has been bitten to a sufficient depth; then the whole of the etching protective is removed, merely the tops of the lines are re-inked, and a final immersion in the acid bath brings the whole of the lines to a true V-shape. The last stage is trimming the plate and mounting it on wood the height of type. I have here a slide from a line-block thus made.*

One drawback to this process is that it can only be used in cases where the drawing to be copied is in positive black and white, that is, either in line or dots on the white ground: it cannot represent gradation of tone. The method of photogravure which I have now to describe does that excellently, but the cost of it is too great for the ordinary work of botanic illustration. In the following account of the process you must bear in mind that there are many modifications of it practised, and known under

* Plates I and II, which illustrate this Address, have been produced by this process.

as many different names. A plate of polished copper is first prepared with a grain to receive the picture, usually in this way. A box containing powdered asphalt has its contents agitated by a rotary brush within it, saturating as it were the air in the box; after the lapse of a few seconds to allow the grosser particles to settle, a door in the side is opened and the plate put in for a definite time, usually three minutes. When the plate is withdrawn it is slightly heated over a Bunsen burner so as to cause the fine particles of asphalt to adhere to the plate, but not to run together. A somewhat similar effect may be obtained by spraying with a solution of resin in spirit, or by the old aquatint ground laid with a brush, which ground on drying shrinks into innumerable tiny cracks.

The picture is obtained from a glass positive, or more generally a carbon transparency is especially made from the chosen negative; this is put in the photographic printing-frame, then a mask to cut off clean edges all round the print, and above it another piece of carbon tissue, sensitized with bichromate salts and gelatine, to form what is termed the gelatine resist. When finished, it is carefully pressed down upon the previously-prepared copper plate, and then placed in water, when the paper backing of the tissue can be removed, and the soluble gelatine washed off, leaving only the oxidised portion on the metal. The back of the plate being coated with varnish, it is put into a bath containing a weak solution of perchloride of iron; several bitings are required of varying strengths, and the resources of the etcher are brought into play, such as stopping out to prevent further action of the etching solution, removing the ground in places for deeper biting, and the like. On washing off the protective film, the plate is proved by the printer.

The plate (Kerguelen Land, from Chun's 'Aus den Tiefen des Weltmeeres,' 1903) here shown does not give the most satisfactory view of this process from a botanic point of view; indeed, the botanic interest in the plate before you is but slight, and is confined to the patches of *Azorella* in the foreground.

The process far more commonly employed for wash or half-tone drawings is produced by means of a screen of finely ruled glass placed just in front of the plate in a camera. These screens are the key to the whole process, and consist of two, cemented together at right angles to the ruling, thus cutting up the field into minute squares. The glass is ruled by machine, from 70 lines to the inch for common journalistic work, to 200 to the inch for the finest results in magazine work. The squares of the screen are

reproduced as dots in the finished plate, which is sensitized by a compound of fish-glue, chromic acid, bichromate of ammonia, and water. Three to ten minutes under the arc-light is enough time to print the picture from the negative, and then the unattacked albumen is washed off under a spray. At this stage the picture is almost invisible; it is therefore dipped into a solution of methyl violet, which stains the film and brings up the picture. The plate is next heated by a Bunsen burner, the so-called enamelling, till the picture becomes of a rich brown tint, when the heating has to be discontinued. The plate is then etched with perchloride of iron, at first all over, then treated by stopping out, or cutting out the high lights, by special craftsmen, to obtain the desired

Fig. 23.—Galls on the leaves of *Salix Caprea*. From Connold's 'British Galls,' 1904 (reduced in size). Half-tone.

effect; and mounting on wood, as in other processes, completes the task of the workman.* The four slides now shown display the scope of the half-tone process: a group of flowers, from a recent number of 'The Garden'; *Pecopteris plumosa* (a fossil fern), and a view of preparations in a botanical laboratory with a black background, the last two from the current (1904) volume of the 'Berichte der Deutschen botanischen Gesellschaft'; and galls

* Plate III, illustrating this Address, has been produced by this process, with a screen ruled to 150 lines to the inch. With a screen ruled to the fineness of 200 lines to the inch, the impression can only be satisfactorily printed on highly glazed paper, the surface of which (being coated with China-clay) is perishable.

on the leaves of sallow, *Salix Caprea*, from Connold's new book on British galls, plate 110. With regard to the last plate notice the pseudoscopic effect due to the negative having been taken with the light from below, or more probably, the specimens inverted; on reversing the slide in the lantern you see that the galls now show as prominences, whereas before they resembled hollows (see Fig. 23).*

While the screen produces the smoothest and best result, it is not indispensable. Here is a slide from a German source; the drawing has been made on a paper with a strong grain, with the outline and lettering in ink, and the shading in lithographic chalk. This is then transferred to a lithographic stone, so as to preserve the actual drawing; the rest of the process is by transfer and as in half-tone or line blocks. It is a simple way of producing a given result, but as the work is shallow it is apt to be soon clogged in printing. There are many kinds of grained paper used for this method, according to the fancy of the draughtsman, but the coarser patterns make a clean outline or delicate lettering almost impossible.

An older process than some of those just detailed is that usually termed in this country Collotype or Heliotype. It is based upon the well-known property of light on bichromatized gelatine, that of hardening it and at the same time rendering it insoluble in water. The printing-plate is a piece of glass about half an inch thick, ground on one side the better to hold the film. On this is spread a basis of albumen, water-glass, and water, over which is laid a fluid film of gelatine, albumen, and bichromate of potash in water. This compound film has to be dried by heat, requiring about four hours in a special oven to effect this; when cool it is ready for receiving the print. The margins are masked by strips of tinfoil, and, the negative being applied, the printing takes place, requiring from twenty minutes to half an hour; but the progress cannot be looked at during the printing. Next follows washing for half an hour, to remove all traces of unutilised bichromate, and then the plate is dried naturally. Printing is usually done in a lithographic press; the film is wetted with a solution of salt, glycerine, and water, and allowed to soak a short time, then inked by a leather roller which inks the stronger parts of the picture, and this is followed by a gelatine

* This was photographed through a screen ruled to 200 lines to the inch, this extreme fineness being necessitated by the large plate from which it was taken being already in half-tone. It is a severe test of the skill of the producers of the block, Messrs. André & Sleigh, and of our printers. See preceding footnote.

roller, which inks the more delicate parts, and it is then pulled on ordinary printing-paper. The film thus takes a gradated amount of ink, corresponding to the negative. There is one drawback to this effective and beautiful process, and that is, no dependence can be placed on the durability of the film, which may break up in the press, almost without notice; consequently the workman is obliged to have a second film in reserve, in case the first one gives way; another inconvenience is the length of time the collotype ink takes to dry on the paper. The samples shown are of dried specimens of gentians, a garden variety of a flowering shrub, and *Salvia* leaves (Pl. III, fig. 4); the latter displays a pseudoscopic effect on being turned upside down, as though the under sides of the leaves were shown.

The last process which I have to describe is that known as Woodburytype, from the name of its inventor. The method is practically the same as it was left at his death. It represents the object with the minutest detail absolutely without grain of any kind. A thick film of gelatine and bichromate is exposed under a negative, and washed free from unused portions, and when dry it is practically incompressible. It is then placed in a steel box with a thick plate of lead above it, and pressure of about two tons to the inch is applied, as in the previously-described Bradbury's Nature Printing. This lead forms the matrix for printing. It is placed on a press with a hinged lid of glass, and the face of the lead being slightly oiled, a small amount of warm gelatine, tinted as required, is poured on it, paper placed upon it, and the lid shut down. In a few minutes the fluid gelatine has set, and on opening the mould the sheet of paper turns out with the coating of impressed coloured gelatine, which, after immersion in a bath of alum to render it permanent, has to be dried and trimmed to form the perfect print. The original gelatine is quite unharmed by the heavy pressure, and can be used repeatedly for new lead matrices. Owing to the slow printing, and every print having to be mounted, the cost is almost prohibitive for plates of botanic subjects. I have no slide to represent this process, but I place on the table prints from the same negative, showing the difference between Collotype and Woodburytype.

I have only given a very brief outline of the modern processes, for they are so varied by different practitioners that I cannot pretend to describe all the modifications employed. I have endeavoured to explain how the modern blocks are made, at all events in the main methods used, and, though necessarily brief, I trust I have made the processes intelligible.

And now, ladies and gentlemen, my task is ended; my term of office having expired, my tenure of this Chair will soon be of the past. I shall not forget the honour you have done me by calling me to the chief office of this Society during the last two years, and it will always be a source of high gratification for future remembrance. That the Hertfordshire Natural History Society and Field Club may continue to flourish, and may ever grow in reputation and usefulness, is my farewell desire this evening.

XXI.

COLEOPTERA NEW TO THE HERTFORDSHIRE FAUNA.

By A. E. Gibbs, F.L.S., F.R.H.S.

Read at Watford, 19th April, 1904.

In the first volume of the 'Victoria History of Hertfordshire,' Mr. E. George Elliman, of The Broadway, Chesham, formerly of Tring, has published a most valuable list of Coleoptera observed in Hertfordshire. No less than 1,542 species are recorded as having been taken in the county, mostly by Mr. Elliman himself, and he expresses the belief that these figures represent very inadequately the total number likely to be found, he having observed nearly a hundred additional species in Buckinghamshire, within three or four miles of the Hertfordshire boundary. Mr. Elliman now adds thirteen beetles to the list, thus bringing up the number known to inhabit Hertfordshire to the respectable total of 1,555, or about half the British species. The thirteen new records are:—

Pterostichus anthracinus, Ill.—Near Chorley Wood.
Homalota vilis, Er.—Little Tring, in dead rushes.
Oligota flavicornis, Lac.—Little Tring.
Aphodius porcus, F.—Tring.
Podagrica fuscipes, L.—Broxbourne, taken by Mr. F. B. Jennings.
Apion annulipes, Wenck.—One female taken at Aldbury Owers.
A very rare insect in this country, especially the male.
A. filirostre, Kirby.—Near Flaunden.
A. rufirostre, F.—Broxbourne.
Tanymecus palliatus, F.—Cheshunt.
Hypera pollux, F., var. *alternatus*, Steph.—Cheshunt.
Magdalis barbicornis, Latr.—Cheshunt.
} Taken by Mr. F. B. Jennings. *Vide* 'Entomologists' Monthly Magazine,' series II, vol. xiv, p. 278.
Hylesinus vittatus, F.—Little Tring, by sweeping under elm-trees.
H. oleiperda, F.—Near Flaunden.

XXII.

A NEOLITHIC CELT FOUND NEAR BERKHAMSTED COMMON.

By Sir John Evans, K.C.B., D.C.L., LL.D., Sc.D., F.R.S., etc.

Read at Watford, 29th March, 1905.

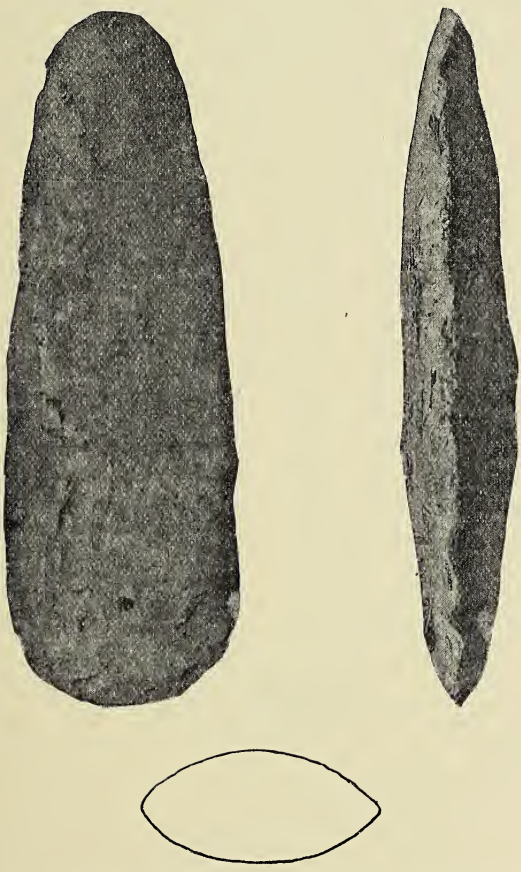


Fig. 24.—Neolithic celt found in digging at Manor End, Berkhamsted. One-half natural size.

I have to place on record the finding of a Neolithic implement in Hertfordshire.

About twelve months ago I became the owner of an acre of ground on the north side of the lane leading from Berkhamsted

past Millfield House to the Common, and about 150 yards to the south-west of "The Kennels" and half a mile north-west of the bridge over the London and North-Western Railway. The spot is now known as Manor End, a house having been built upon it for Mr. J. R. Thursfield. Its elevation is about 530 feet above Ordnance datum.

It was in planting operations on this site in March, 1904, that Mr. Thursfield himself found the implement that I will now describe. It is a celt or hatchet of grey flint, much of the same character as fig. 23 in 'Stone Implements,' but rather longer in its proportions, being 7 inches long and $2\frac{3}{8}$ inches broad in its widest part. The greatest thickness is $1\frac{1}{8}$ inch. It is entirely free from any rust-marks, such as it would no doubt have acquired had it been lying on the surface, and it must therefore have lain undisturbed in the ground until the deep digging in order to plant trees brought it to the surface. It has been very carefully chipped into symmetrical form, but bears no trace of grinding or polishing. It is equally convex on both faces.

For rough work such axes must have been as efficient as those the edges of which were ground sharp, and of course they were far easier to manufacture. Such implements are probably more abundant than is usually supposed, but a more cultivated eye is required to single them out from among other flints than is the case with those which have evidently been ground or polished by the hand of men.

XXIII.

NOTES ON LEPIDOPTERA OBSERVED IN HERTFORDSHIRE IN THE YEAR 1904.

By A. E. Gibbs, F.L.S., F.R.H.S.

Read at Watford, 29th March, 1905.

The year 1904 must, I fear, be regarded by the working entomologist with a certain amount of disappointment. Notwithstanding the apparently favourable weather, insects were not plentiful. Sallows came into bloom rather late and proved fairly remunerative, but "sugar" throughout the year was a failure. I have only seven species to add to the county list, as against nine for the previous year, bringing the number of butterflies and moths on our record up to 1165. I cannot announce the presence in our midst of any very surprising visitor, though one or two of the newly-recorded species are far from common. Of the seven additions one species was observed both by Miss Alice Dickinson, near St. Albans, and by Mr. A. H. Foster, in North Herts. Two others are to be credited to Miss Dickinson, and one other to Mr. Foster. The remaining three records are by Mr. V. P. Kitchin, Mr. A. T. Goodson, and myself.

The species new to our list are :—

1. *Xylina semibrunnea*, Haw. Baldock: A. H. Foster.

Four specimens were taken at sugar, near Baldock, in August and September, by Mr. A. H. Foster, of The Grange. This is a local species and usually scarce, but though not previously recorded in Hertfordshire it has been taken in the adjoining counties of Cambridge, Middlesex, and Essex. Mr. Foster was fortunate in securing so many specimens of an insect which is usually looked upon as a rarity.

2. *Melanippe galiata*, Hb. St. Albans: Miss Alice Dickinson.

This geometer was taken by Miss Dickinson near Sparrowswick Wood at dusk. It is a species more particularly attached to the coast, but is found inland not uncommonly upon Cretaceous formations. It is recorded for Middlesex.

3. *Anticlea cucullata*, Hufn. (*sinuata*, Hb.). St. Albans: Miss Alice Dickinson. Hexton: A. H. Foster.

Two observers report the capture of this species. Miss Dickinson caught a specimen in the garden at New Farm, St. Albans, and Mr. Foster beat five specimens out of a hedge on the chalk hills near Hexton during three visits in July. This is another chalk-loving species, and appears in the Middlesex and Essex lists.

4. *Cidaria siterata*, Hufn. (*psitticata*, Schiff.). Tring: A. T. Goodson.

Bred by Mr. Goodson from a larva taken at Tring. It is a pretty autumnal geometer now recorded for the first time for our county, though Mr. Barrett in 'British Lepidoptera' says that it occurs in Cambs, Beds, and Essex. It is often abundant in its favourite

haunts, chiefly in the southern counties, and in such localities comes freely to ivy-bloom.

5. *Scoparia angustea*, St. Watford: V. P. Kitchin.

This Pyralid was taken at Watford by Mr. Kitchin in 1900. It is stated by Mr. Barrett to be an insect which is most plentiful and most generally distributed on the coast, more local inland, but to frequent suitable places throughout England and Scotland. I have found no records of its occurrence in neighbouring counties, except Essex, but it may have been overlooked.

6. *Aciptilia galactodactyla*, Hb. St. Albans: Miss A. Dickinson.

Miss Dickinson sent me a specimen of this plume moth among some micros captured near St. Albans. The larvæ feed on burdock-leaves, the imagos being rarely seen. The moth is recorded from Cambridge, Middlesex, and Essex.

7. *Tinea* (*Scardia*) *granella*, L. St. Albans: A. E. Gibbs.

A specimen of this little moth was caught by me at St. Albans. It has been identified by the Rev. E. N. Bloomfield and the late Mr. C. G. Barrett.

So far as the Rhopalocera are concerned there is little to report. Miss Dickinson is the only correspondent who sends any details with regard to them, though most collectors allude to their scarcity. The only exception to this was that common pest the small cabbage-white butterfly (*Pieris rapæ*), the second brood of which, Miss Dickinson says, flew in swarms in all the fields at New Farm, St. Albans. In my garden I take a rather interesting aberration of the male of this insect, in which the black marking at the tip of the wing is entirely wanting or only very faintly indicated. The extreme form has been given the name of ab. *immaculata*. It occurs in the spring, the early brood in this species being generally much less strongly marked than the summer generation. I show specimens for comparison. Both broods of *Colias edusa* were present, but not in any abundance. Mr. Arthur Dickinson saw single specimens on May 20th and August 2nd.

Argynnis paphia, the silver-washed fritillary, was seen at Symond's Hyde Wood by Miss Dickinson on August 1st. The only species of *Vanessa* reported is *V. atalanta*, the red admiral, a small specimen of which was seen by the same observer so early as August 22nd. Miss Dickinson also remarks that the common blue, *Lycæna icarus*, generally so abundant, was scarce, and the same remark applies to the holly-blue, *L. argiolus*, one specimen only of which was seen between Redbourn and Hemel Hempstead. This latter species was not observed in my garden in 1904. The two commonest skippers, *Syrichthus alveolus* and *Thanaos tages*, were scarce, and a few specimens of the small skipper, *Hesperia linea*, were taken by Miss Dickinson at Symond's Hyde on August 1st.

One of the interesting features of the year has been the comparatively large number of captures throughout the country of the striped hawk-moth, *Deilephila livornica*. Its headquarters were apparently at Bournemouth, but specimens were caught in nearly all the southern counties from Cornwall to Kent, and it

was taken so far north as Carlisle. There are several records from Wales, but I cannot find any notice of its occurrence in the midland, and I can only find one in the eastern, counties, this solitary record being that of a specimen taken at Felixstowe. *D. livornica* occurred both in the spring and autumn, and the probability appears to be that the early specimens were immigrants, the fringe of a great general movement northwards from the shores of Africa, while the autumn captures were British-born offspring of these travellers. I cannot hear of any stragglers having reached our county, but I have a note of the occurrence of *D. livornica* at Battler's Green, Aldenham, in 1898, which has not yet found a place on our record. The specimen I show was taken by Miss Ada Selby in her garden at Battler's Green, and I learn from her that she has since caught a second example at the same place. In a previous report I have drawn attention to one other appearance of this fine moth in our county twenty years previously, Mr. W. C. Boyd having been fortunate enough to take it at Cheshunt on 25th August, 1868. Another of the large Sphinges, *Sphinx convolvuli*, the convolvulus hawk-moth, was also remarkably abundant last year. A specimen, very much damaged, was brought to me from Harpurbury, and I heard of a second being taken in the outskirts of St. Albans. Mr. Barraud also records it from Bushey Heath. Another interesting capture is that of the small elephant hawk-moth, *Chærocampa porcellus*, by Mr. Arthur Cottam at Watford. On the 2nd of July he took a female specimen of this beautiful moth flying over a honeysuckle bush in his garden.

On the 1st of May I noticed on the aconite plants at Kitchener's Meads, a number of small green larvæ covered with hairy tubercles. They had drawn together the young leaves of the terminal shoots, and were eating out the undeveloped flower-buds. Suspecting that they were the young caterpillars of *Plusia moneta*, I collected them for observation. When placed in the larva-cage they fed up quickly. After the first change of skin the creature entirely changes its appearance and becomes a caterpillar of a pronounced *Plusia* type, of a bright green colour, with a paler spiracular line, and with the anterior segments smaller than the succeeding ones. It is very partial to monkshood, *Aconitum napellus*, though delphinium is generally regarded as its favourite plant, and it is also said to feed upon the globe-flower, *Trollius europæus*, but my larvæ rejected both these latter plants in favour of aconite. I tried to induce them to accept delphinium, but they contented themselves with nibbling the young leaves, and then returned to the monkshood. There are many clumps of delphinium growing in the garden, but no trace of the larvæ of *Moneta* was discovered upon them. The pupa is enclosed in a cocoon of white silk, which assumes a bright golden yellow colour in the presence of moisture, the change in tint even being caused by the introduction of a damp sprig of the food-plant into the cage. The cocoons are generally formed on the underside of the lower leaves, the colour

of the cocoon harmonizing well with the tint of the older foliage. The young larvæ captured on the 1st of May began to spin-up on the roof of the cage on the 14th of the same month, and the first moth appeared on 14th June. Miss Dickinson also reports taking the larvæ of this insect in June on delphinium, and she successfully reared them, the moths appearing in July, a rather later record than mine. She says: "I found the larvæ of this beautiful moth by noticing the leaves drooping. I think they commence feeding near the stalk on the mid-ribs of the leaves, and so cause the leaves to give way and wither. On examination I found on each a young caterpillar protected by a thin web. I at first thought that the wind was responsible for the broken leaves. In July I watched a female moth depositing eggs on the green seed-pods. This rather surprised me, for my delphiniums are generally cut down twice in the season." It is remarkable how quickly this moth, which was captured in Britain for the first time in 1890, at Dover, has spread over the southern part of our Island, and how firmly it has established itself. It bids fair to become one of our commonest garden moths. Its life-history is not at present thoroughly understood, but the species has lately attracted a great deal of attention, and we shall doubtless soon possess more information about it. I exhibit a series of 26 specimens which were reared in 1904 from the larvæ taken in the garden.

The insects secured at sallow in the neighbourhood of St. Albans in the spring included, besides the commoner species, *Tæniocampa populeti*, *Pachnobia rubricosa*, and *Panolis pipiperda*, the last-named insect having only been taken at one other Hertfordshire locality in recent years, viz. Watford, by Mr. Wigg. It has a special interest for us, because, although now a rather common insect in those parts of England where its food-plant, the Scotch fir, *Pinus sylvestris*, grows, the first British specimen was taken at Hertford in 1810 by Mr. J. F. Stevens, to whose life and local records I alluded at some length last year. On 17th April a female *Pachnobia rubricosa*, taken at some young sallows which I have planted in the garden for the purpose of attracting moths, deposited a batch of eggs in a chip-box. On the 21st the young larvæ commenced to emerge, and so soon as they were of sufficient size they were sleeved on balsam-poplar, and in due course went through their several changes. The first perfect insect emerged on 18th March, 1905.

I sugared in the vicinity of the city on several occasions during the summer with very unsatisfactory results, the only insects taken in this way being *Acronycta megacephala*, *Rusina tenebrosa*, *Noctua festiva*, *Euplexia lucipara*, and *Dianthecia cucubali*, and in the autumn at Bricket Wood, *Thyatira batis*, and other common Noctuæ. A specimen of the black aberration of *Amphidasys betularia*, known as *Doubledayaria*, emerged at the Museum from a chrysalis dug in Clarence Park. *Eupithecia lariciata*, which is new to the St. Albans list, occurred at Gorhambury.

Miss Alice Dickinson, to whose diligent observation we owe so

much, reports that she counted about 40 larvæ of *Dicranura vinula* both on willow and balsam-poplar near her home. Many of them were destroyed by birds. Other species which she has not previously reported were observed as follows:—*Notodonta ziczac* (larva), *Acronycta psi*, *Miana strigilis*, *M. typica*, *M. maura*, *Tryphæna interjecta*, *Cosmia pyralina*, *Dianthecia cucubali*, *Habrostola tripartita*, *H. triplasia*, *Selenia lunaria*, *Odontopera bidentata*, *Amphidasys prodromaria*, *A. betularia*, *Geometra vernaria*, *Iodis lactearia*, *Bapta temerata*, *Abraxis grossulariata* (very abundant —some richly-marked forms), *Hybernia leucophearia*, *Emmelisia alchemillata*, *E. decolorata* (larvæ), *Eupithecia absinthiata* (larvæ on wormwood), *Thera variata*, *Melanthia albicillata*, *Anticlea nigrofasciaria* (*derivata*), *Scotosia rhamnata*, and *Eubolia limitata* (*mensuraria*). An interesting note is contributed with regard to *Abraxis sylvata* (*ulmata*), which she points out has disappeared from Batchwood, where formerly it was generally to be found.

Mr. Arthur Cottam reports that his captures at Watford were very few. In addition to the female *Chærocampa porcellus* which he caught on July 2nd, to which reference has already been made, he took, flying over the same honeysuckle bush, during the following week or ten days, a good series of *Plusia chrysitis* and *P. iota*, all fine and in good condition, and besides, six *P. moneta* and two very fine *Pericallia syringaria*. Mr. Cottam found that very few insects were attracted to light in his dressing-room, which in some years has brought very good things; the only moth worth mentioning which was secured in this way in 1904 being *Calymnia pyralina*. Of micros he took none, and throughout the year he found insects scarce.

Mr. P. J. Barraud's report is also unfortunately a short one. He worked with the light-trap during the season, and took about the usual number of insects, including two species which had not previously occurred at Bushey Heath, viz., *Tethia subtusa*, hitherto recorded only from Hertford, Sandridge, and Cheshunt Marsh, and *Ennomos fuscantaria*, a more widely-distributed moth. The number of species taken at light at Bushey Heath by Mr. Barraud now reaches 300. Among the more noteworthy insects secured during the year in this way were *Hylophila bicolorana*, *Pterostoma palpina*, *Thyatira batis*, *Dipterygia pinastri*, *Cerigo matura*, *Apamia ophiogramma*, *Calymnia pyralina*, *Dianthecia capsincola*, *Plusia moneta*, *Pseudoterpna cytisaria*, *Eupithecia subfulvata*, *Eubolia plumbaria*, and *Xanthosetia zoegana*. Mr. Barraud paid one or two visits to the Tring district, and observed among other things *Epinephile hyperanthus*, *Lycæna agestis*, *L. corydon*, *Nisoniades tages*, *Hesperia thaumas*, *H. comma*, *Zygæna filipendulæ*, *Demas coryli* (one only), and *Eubolia limitata*. No sugaring or sallowing was done by him in the county, and ivy yielded nothing worth recording.

In addition to the species which Mr. V. P. Kitchin has added to our list, he reports several interesting insects from the Watford district. In 1902 he took one specimen of *Notodonta dodonea* at light at Watford, a second specimen of *Chilo mucronellus*, and one

specimen of *C. forficellus*, also at light at Bushey. During the past season he secured in the same way six specimens of *Pœcilocampa populi*, one of which strangely was a female, and five specimens of *Asteroscopus sphinx*.

From Tring Mr. A. T. Goodson reports the same unsatisfactory state of things. He, however, adds six species to the Tring list, one of which now appears for the first time as a Hertfordshire insect. These six are *Ino geryon*, previously reported to us from Hitchin only; *Notodonta dictæoides*, larva on birch; *Melanthia bicolorata*, flying at the reservoirs; *Cidaria siterata*, one of the additions to our list; *Eubolia cervinata*; and *Scopula ferrugalis*, noted previously only at Sandridge and Cheshunt, which was taken on November 10th on the window of the taxidermist's room at the Museum. The larvæ of *Chesias spartiata* was also taken on broom at Hastoe.

Mr. W. C. Boyd reports the recurrence of *Myelophila cribrella* at Waltham Cross. He also found *Camptogramma fluviata* sitting on some palings. This moth was first observed in the county by Mr. Goodson at Tring in 1902.

Mr. A. H. Foster, of The Grange, Hitchin, says: "I have found this season a very poor one for most things, but a few insects have occurred abundantly which are not usually at all common, and I have met with more things new to me than in any other season I can remember, perhaps because I have tried to find them more." The following are the most noteworthy of Mr. Foster's captures:—*Luperina cespitis*, *Caradrina alsines* (a fine variety), *Cirrhœdia xerampelina*, *Hadena genistæ*, *Xylina semibrunnea*, *Ennomos fuscantaria*, *Eupithecia succentauriata*, *E. subfulvata*, *E. subumbrata* (*scabiosata*), *E. subnotata*, *E. exiguata* (many), *Lobophora viretata*, *Thera obeliscata*, *Melanippe rivata*, *Anticlea cucullata* (*sinuata*), *Scotosia certata*, *S. vetulata*, and *S. rhamnata*.

It will be remembered that in my last report I discussed the possibility of the purple emperor butterfly still surviving in some of our larger oak woods. Although I am not yet able to produce a Hertfordshire specimen of *Apatura iris* for inspection, I am glad to be able to state that Mr. Foster has obtained some further evidence of its occurrence in the county. Mr. Samuel Lucas, of Tilehouse, Hitchin, has informed our correspondent that he distinctly remembers a specimen being taken many years ago in Stagenhoe Lane. The specimen found its way into the collection of Mr. Lucas's cousin, at Wratton Cottage, Hitchin, but that collection no longer exists. Stagenhoe Lane, it is interesting to note, is along the top edge of Hitch Wood, a locality which Mr. Foster mentioned last year as being still a possible haunt of the insect. I sincerely hope that *iris* is still a native of our shire, and that we may, before long, be able to show a genuine Hertfordshire specimen in the County Museum.

VARIATION IN MELITÆA AURINIA.

XXIV.

NOTES ON VARIATION IN *MELITÆA AURINIA* (*ARTEMIS*).

By V. P. Kitchin, B.A.

Read at Watford, 29th March, 1905.

PLATE IV.

I have been asked by one of our Secretaries to write a short paper with the object of pointing out the chief tendencies to variation in *Melitæa aurinia*, as noted from my series of 110 Irish specimens.

The typical Irish form, as is probably known to members of the Society, is more highly-coloured and therefore handsomer than the English type. Fig. 12 shows the usual Irish form. This greater brilliancy is due principally to the yellow bands, patches, and spots being generally free from that suffusion of the reddish-brown ground-colour which tones them down in the English specimens.

Variations in General Appearance.—The ground-colour of the wings varies from pale dull reddish-brown to chestnut, and seems generally to gain in tone by force of contrast with the clear yellow of the bands and spots and the deep black of their outlines. There are three principal variations in general appearance, according as either the chestnut, or the yellow, or the black predominates. In some specimens the total area of yellow in the wings is very great (see fig. 11), being supplemented by a fuller development of the extra row of yellow splashes between the wing-nervures towards the hind-margin, which is as a rule only faintly indicated in English specimens, and by the restriction in width of the black outlines and bands. Other individuals show a great increase in the black area; the bands and outlines are heavy and monopolise much space that should be yellow or chestnut (see fig. 2). A few only in the series of 110 Irish specimens show a tendency towards the suffused yellow of the English types.

So much for general variation. I will now attempt to describe a few more specific cases.

Variations of the Upper Wing.—The only variety of which I have been able to discover the name is that called ab. *virgata* (see fig. 1). In this the black band dividing the yellow patch near the middle of the costa is wanting. I have also specimens graduating from a very thin band to spots between the nervures; others show mere traces of the band. The opposite extreme is reached in fig. 2, in which the black band has usurped a goodly proportion of the yellow patch. This same band is sometimes suffused with red at the edges, the suffusion occasionally extending over the inner portion of the yellow patch.

Another band which varies greatly is that which crosses the yellow patch on the hind-margin. It is sometimes very broad

(fig. 2), and specimens could be picked showing graduation in width down to fig. 3, in which the band has diminished to a mere spot. This variety closely approaches that named *merope*, which is found on the Alps. Other specimens show the band of a powdery reddish appearance, edged on the outer side by a thin line of black.

Fig. 4 is a dwarfish variety with very narrow fore-wings. In fig. 5 is shown a specimen in which two of the wing-nervures on the upper wing (numbers 5 and 6) and one on the under wing are entirely missing, and are not even marked by the usual black lines. Fig. 10 shows also the half of wing-nervure number 6 (on upper wing) lacking.

Variations of the Under Wing.—The central spot and lower spot in the band are missing in fig. 6. The same specimen shows the row of crescents round the hind-margin of the wing greatly reduced in size, and brownish yellow instead of clear whitish yellow.

Fig. 7 shows a variation often present in ab. *virgata*. The yellow fascia or band of spots is continued almost to the base of the wing by an irregular oblong yellow patch. A similar extension of the corresponding band on the under-side is not infrequently found on the same specimens. It occurs also when the upper surface does not correspond (see fig. 9).

Variations of the Under Side.—Black bands are sometimes found near the inner margin and costa corresponding to those on the upper side.

The pale yellow fascia on the under wing is sometimes powdered with black scales. In fig. 8 it lacks the outer black line.* Fig. 9 shows the spots of the yellow band joined to the basal patches to form irregular markings, and continued almost to the base of the wing by an oblong yellow patch.

Variation of the Antennæ.—I have one specimen in which the antennæ are noticeably shorter than usual.

Pathological Aberrations. — Several specimens have upper wings of different shapes and sizes on either side. In fig. 2 the costa is straight on the left side and curved on the right.

Fig. 10 is that of a specimen which I watched emerging from the pupa. The wings lack scales over most of their area, but the fringes are all perfect. One wing-nervure is half missing (number 6 on upper wing).

Minor Variations.—Sometimes small black dots appear in the yellow patches, while again some of the black spots on the under wing may be missing (see fig. 6).

These are the main variations which I have noticed.

* There seems to be a tendency in most of the species of *Melitæa* towards this variation, in which the black markings are restricted to the basal portion of the under-side of both wings. I have in my possession a figure from a photograph of *Melitæa didyma* captured in Central France, which shows a similar absence of black markings except close to the base, and in a coloured plate issued in the 'Transactions of the Linnean Society of Bordeaux' (lent to me by a friend) appears a similar variety of *Melitæa Phœbe*.

LARVÆ AND PUPÆ.—Perhaps as this paper is entirely devoted to *aurinia*, a few remarks on the larvæ and pupæ may not be out of place.

The former may be found about half-grown, hibernating gregariously in a web affixed among the herbage.* In the Spring they emerge and scatter, feeding alone. During April they are very easy to obtain, as they like to sun themselves on a leaf of their food-plants (plantain and devil's bit scabious). They are thus an easy prey to parasites, and a great number of them perish from this cause. I obtained four or five different species of parasites. Infested pupæ are excellent for the cabinet when the flies have emerged, as the colour is beautifully preserved. The full-fed larva suspends itself by the tail to some convenient plant. In Galway a heather-plant was usually chosen, and the larva climbed as high as it could.

The pupæ are not hard to find, though the larvæ, which at first glance greatly resemble those of *Vanessa Io*, are much more easily obtainable, as they make no attempt at concealment.

Melitæa aurinia is a Hertfordshire butterfly. It was first recorded for the county (as *M. artemis*) in 1885, in our 'Transactions' (Vol. III, pp. 265, 266), as having been "taken at Knebworth Wood by Mr. B. Christian two or three years ago" (*i.e.* before 1885). It has also been taken at Haileybury near Hertford several times lately, as recorded by Mr. A. E. Gibbs in his article on the Lepidoptera in the 'Victoria History of the County of Hertford' (vol. i, p. 148, 1902).

* They are most frequently found upon low meadows or marshy land, but in Galway County they frequent also the slopes of the limestone hills.

XXV.

COLEOPTERA OBSERVED IN HERTFORDSHIRE IN 1904.

By E. George Elliman.

Read at Watford, 29th March, 1905.

The following additions have been made to the list of Hertfordshire Coleoptera in 1904 :—

Harpalus sabulicola, Panz. Rossway, near Berkhamsted: E. G. Elliman.

Cercyon nigriceps, Marsh. Tring: E. G. Elliman.

Homalota consanguinea, Epp. Tring: E. G. Elliman. Two examples were found in much decayed beech-leaves at Tring. This species was discovered at Hastings in 1871 by Mr. E. Saunders, who only found three specimens, and it had not been noticed since in any part of this country. Surprise was expressed at the time of its discovery that it should have been found in the British Isles, being mainly an Austrian species, and not having been found at all in France up to that time.

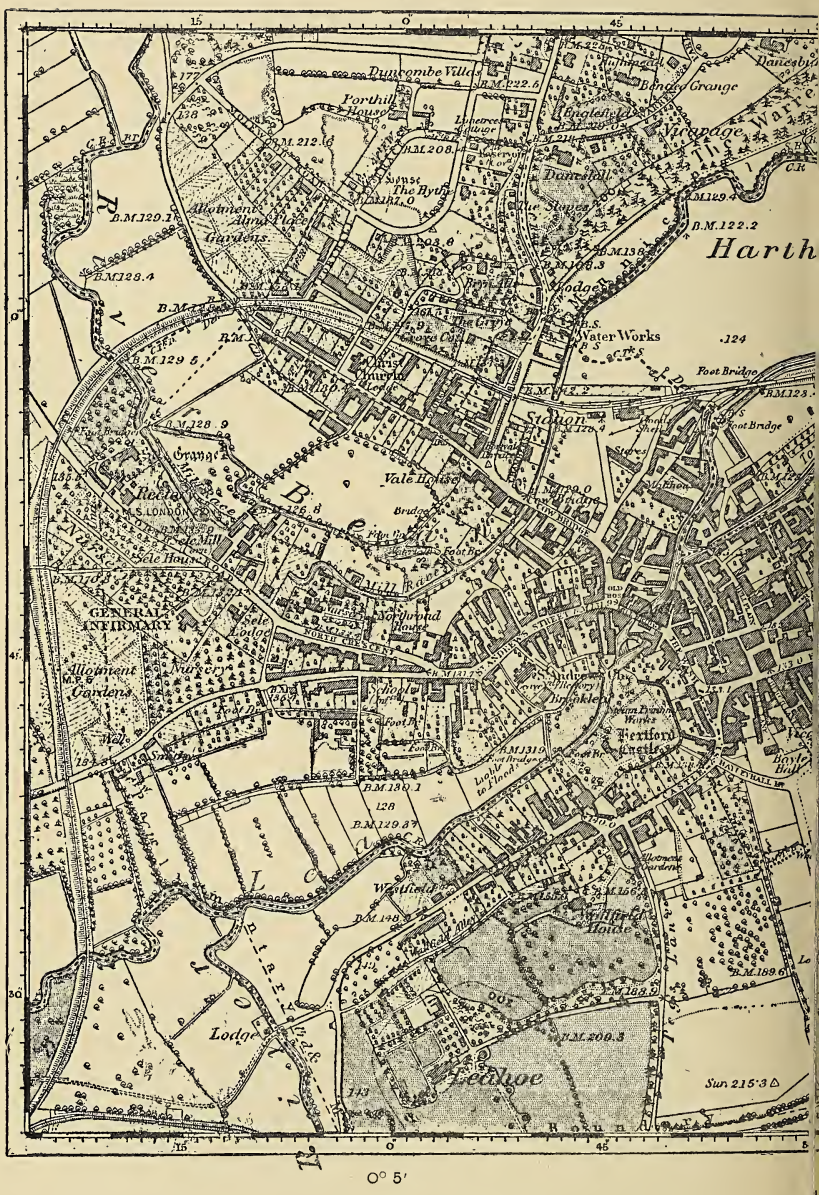
Placusa pumilio, Grav. Rossway: E. G. Elliman. This beetle was found under the bark of oak at Rossway, near Berkhamsted.

Myllæna minuta, Grav. Wigginton: E. G. Elliman. In moss.

Catops sericatus, Chaud. Aldbury: E. G. Elliman. Taken by sweeping at Aldbury. This insect has only recently been recognized as British by Mr. Champion, though it is probably standing in some of our collections under the name of *Catops sericeus*, Fabr., small examples of which it closely resembles in general appearance.

Coccinella hieroglyphica, Linn. Aldbury Owers: E. G. Elliman.

Hister bissexstriatus, Fabr. St. Albans: A. E. Gibbs.



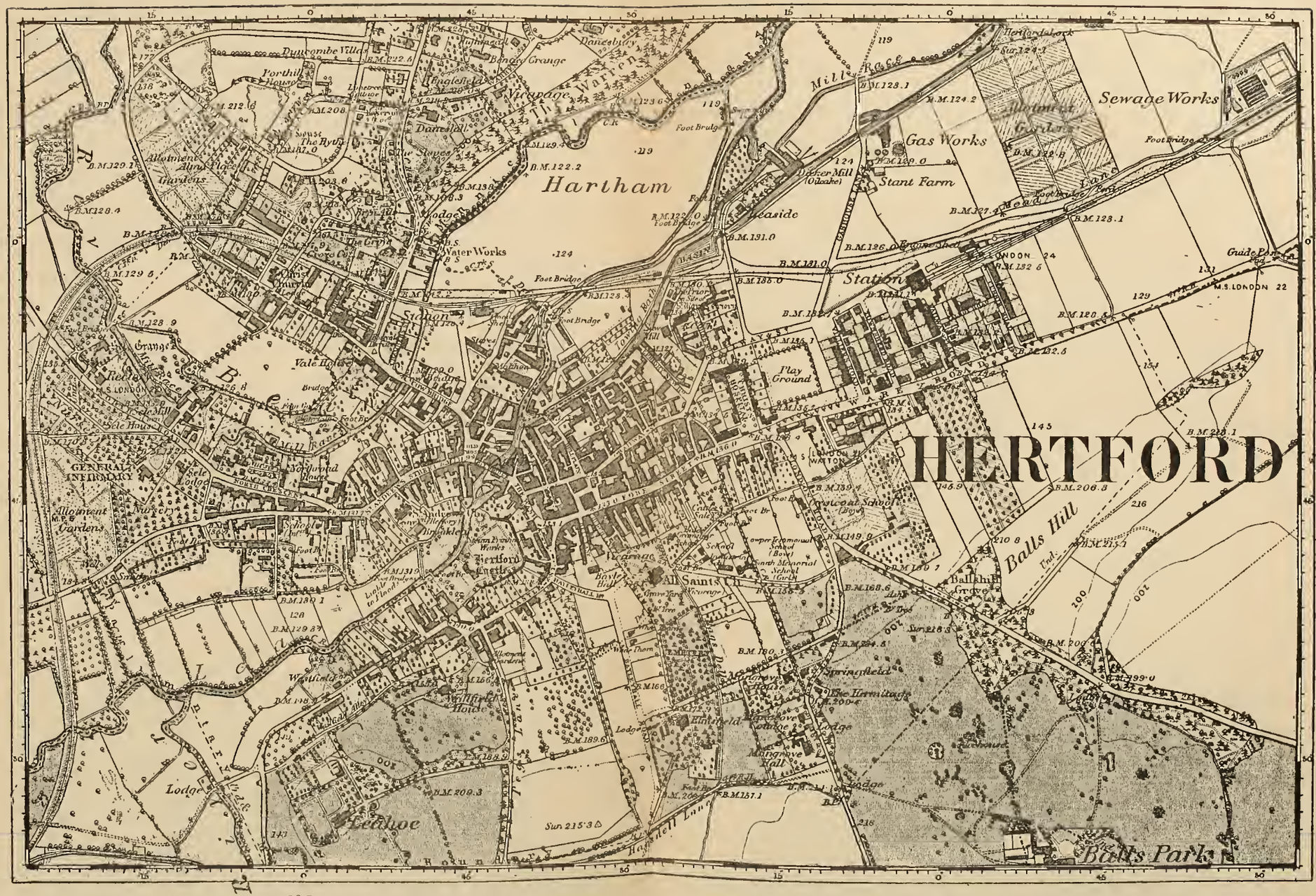
Plan of Hertford, from the six-

[Reproduced by permission of the

0° 4′

Scale—Six Inches to one Statute Mile, or 880 *feet to one inch.*
$= \frac{1}{10\,560}$

rdnance Survey Map, Sheet xxix.
ler of His Majesty's Stationery Office.]



1884.

Scale—Six Inches to one Statute Mile, or 880 feet to one inch.
$= \frac{1}{10560}$

Plan of Hertford, from the six-inch Ordnance Survey Map, Sheet xxix.

[Reproduced by permission of the Controller of His Majesty's Stationery Office.]

XXVI.

HERTFORDSHIRE MAPS: A DESCRIPTIVE CATALOGUE OF THE MAPS OF THE COUNTY, 1579 TO 1900.

By Herbert George Fordham.

Part II: 1673–1794 (*continued*).

(See Vol. XI, Part 6, p. 212.)

1790. Aikin, John. $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles = 1 inch.

Outline map without border, filling page of small octavo volume. Shows boundary of county by finely-dotted line, the principal rivers and their tributaries, including the New River, and the chief towns. In the left-hand top corner: "Hertfordshire." The names of the adjacent counties are also inserted in the map.

From 'England Delineated; or, a Geographical Description of every county in England and Wales: with a concise account of its most important products, natural and artificial. For the use of Young Persons.' This is the second edition of this work; the first edition, published in 1788, has no maps. London, 1790, 8vo.

(Reprinted, 3rd ed. 1795, 4th ed. 1800, 5th ed. 1803, 6th ed. 1809, all with the county maps; and also, with large additions, under the title 'England Described,' 1818, but without maps. The maps are also found bound together, without title, in the Library of the British Museum, the volume containing a manuscript date 1796.)

1791. Harrison, John. $18\frac{1}{4} \times 13$. Scale, about $2\frac{1}{2}$ miles = 1 inch. [Engraved July 4, 1788.]

Rather a plain, bare-looking map, giving the boundaries of the hundreds, and the rivers, main and cross roads, towns, villages, hamlets, and principal houses, and a few hills. Meridian lines across the map, the longitude from St. Paul's. In right-hand top corner, in rectangular panel: "A Map of Hertfordshire, Engraved from an Actual Survey, with Improvements," and a star-indicator of the north at the top of the line of 20′ W. longitude. In the left-hand bottom corner a reference to the hundreds, and a scale of miles: "English Statute Miles $69\frac{1}{2}$ to a Degree." Below bottom margin: "London, Engraved for J. Harrison, 115, Newgate Street, as the Act directs, July 4, 1788," and "Haywood *del.* . . . Sudlow *sc.*"

From 'Maps of the English Counties, with the Subdivisions of Hundreds, Wapontakes, Lathes, Wards, Divisions, Etc. to which are added two folio pages of Letter-Press, to face each Map; descriptive of the Extent, Boundaries, Rivers, Lakes, Canals, Soil, Mines, Minerals, Curious Plants, Husbandry, and every Curiosity that is nearly connected with the Maps. The whole containing the most useful, entertaining, and instructive Selection of the Kind that has yet appeared at the Price of 3£ 3*s*.' London, 1791, large obl. fol.

This work is unpaged, and there is a page of letterpress facing each map. The maps are dated variously from 1787 up to 1791.

(Reprinted in 1792, with an altered title.)

1792. Universal Magazine of Knowledge and Pleasure. $8\frac{7}{8} \times 7\frac{1}{8}$. Scale, 5 miles = 1 inch. Engraved by B. Baker.

Shows rivers, principal roads (with distances from London of chief towns indicated in miles), and many cross roads, with towns, and a few villages, parks, woods, and commons. The margin is plain-ruled, with the latitude and longitude marked in degrees and minutes. In border, at foot, on left: "Longitude West from London," and, on right: "Longitude East from London." In the left-hand top corner, in a long, slightly oval-shaped band, shaded vertically: "Hertfordshire," and below, following the curve of the band: "Engraved by B. Baker, Islington." Again lower, a scale of 10 miles. The design is not carried beyond the county boundary, except in one or two cases.

Illustrates 'An Account of Hertfordshire: With a neat and accurate Map of that County,' in vol. xci (1792, September part) of 'The Universal Magazine of Knowledge and Pleasure.' It is: "London: Published under His Majesty's Royal Licence, By W. Bent, at the King's Arms, Pater-noster Row, MDCCXCII." 8vo. This magazine, originally published by John Hinton, ran from 1747 to 1814, or 1815, and in 1792 was in the hands of Bent. A description and map of Herts occur also in 1751.

(The above map of Herts was reprinted from the same plate with additions and amendments in an atlas of county maps issued in 1807 by Laurie & Whittle.)

1792. Cary, John. $3\frac{11}{16} \times 4\frac{7}{8}$. Scale, 10 miles = 1 inch.

The smallest of Cary's maps of Hertfordshire, reduced from the one in the quarto atlas of 1787, and engraved with the north to the right-hand side of the plate. At the points at which the principal roads leave the county particulars are given of their directions, and letters (*a*, *b*, *c*, etc.) are inserted to show their connections with the roads in the adjoining counties. The map has a fine, double-lined border. At the top, projecting from the line of margin of the map about $\frac{5}{16}$ inch, is a narrow panel, with the title: "Hertfordshire" in slightly ornamented capitals on a ground of vertical shading, and on either side: "By J. Cary" . . . "Engraver". Above this title is a half star with indications of S., W., and N. only. In the left-hand bottom corner is a "Scale of (10) Statute Miles". At the foot of the map, within the border, but separated from the design by a thin line, are particulars of distances from London, commencing: "London to Bishops Stortford 29 M. Standon 27 Hoddesdon 17" extending for two and a half lines, and below the border: "London Published Sep^{r}. 1. 1792 by J. Cary Engraver No. 181 Strand".

From 'Cary's Traveller's Companion, or, A Delineation of the Turnpike Roads of England and Wales; shewing the immediate

Rout to every Market and Borough Town throughout the Kingdom. Laid down from the best Authorities, on a New Set of County Maps. To which is added, An Alphabetical List of all the Market Towns, with the Days on which they are held.' London, 1792, 8vo. This is a small pocket atlas of county maps, containing also an "Advertisement", "Contents" (or list of the maps), and, at the end, a list of towns. The engraved title-page is dated, at foot, "1st. Janv. 1791", but all the maps bear date "Sepr. 1 1792", except the folding map of Yorkshire, which is dated "Sepr. 1 1789". There are 43 maps in all in this work. This is the earliest edition of the 'Traveller's Companion.'

In 'Cary's New Itinerary' (of which eleven editions, 1798–1828, were published, all London, 8vo), in a copy of the 5th ed. (1812), there is an advertisement of the "Small Octavo" atlas, in which it is described as being "Peculiarly adapted for the Pocket, and to bind with Cary's New Itinerary, as comprehending those small Branches of Turnpike Road which could not be described in that Work; shewing also the Line of the navigable Canals, Rivers, Etc." This atlas was re-engraved, with slight corrections and additions throughout.

(I have a copy in the re-engraved state dated 1819, and another appears to have been issued about 1824, or later, by J. & G. Cary. There was a subsequent issue, with the names on the map re-written, the railways inserted, and other alterations made on the plate, by G. F. Cruchley about 1862, in his 'Railroad Companion to England and Wales,' of which a copy exists in the British Museum. This last-mentioned work may, of course, have had various editions, and was probably finally reprinted as late as about 1875. In 1876 the plates of this series of county maps, with the rest of Cruchley's stock, were disposed of to Messrs. Gall & Inglis, of Edinburgh, in whose possession they remain. Messrs. Gall & Inglis inform me that they have never printed from this set of plates.)

*** 1792. Harrison, John.** $18\frac{1}{4} \times 13$. Scale, about $2\frac{1}{2}$ miles = 1 inch. [Engraved July 4, 1788.]

An unaltered reprint of the map published in the edition of Harrison's atlas of 1791.

From 'Maps of the English Counties,' by John Harrison—apparently the second, and last, edition—with an abbreviated title as compared with that of 1791, and the price at which the work is to be sold reduced to £2 2*s*.

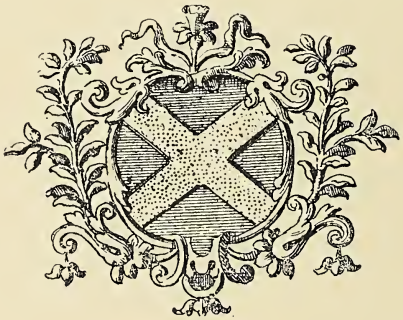
*** 1793. Cary, John.** $10\frac{5}{16} \times 8\frac{1}{4}$. Scale, about $4\frac{1}{2}$ miles = 1 inch.

A re-engraved issue of Cary's map of Herts of 1787, a trifle smaller than the original, and differing slightly in the details throughout. The imprint is altered to: "London. Published Janv. 1 1793 by J. Cary Engraver & Mapseller Strand".

From 'Cary's New and Correct English Atlas,' the second edition, with the title as that of the first, except that at the foot the imprint is altered to: "London. Printed for John Cary, Engraver

and Map-seller, No. 181, near Norfolk Street, Strand. Published as the Act directs Jan^{y}. 1st. 1793." large 4to. The maps in this series are all of the same date, except that of Dorset, which is dated (in error) 1795. They are very exactly copied from the originals as to their general style and appearance, but differ slightly in details throughout, and the writing itself of names on the map is distinguishable from that on the original plates. They retain the meridian of St. Paul's.

(Reprinted in an atlas with the same title about 1818, and possibly at other dates. The plate was afterwards in the possession of G. F. Cruchley, by whom it was used, with the railways inserted, in his 'County Atlas,' of which copies exist in the British Museum of 1863, 1868 (?), 1872 (?), and 1875. In 1876 it was sold to Messrs. Gall & Inglis, of Edinburgh, by whom, however, it has not been used—Cruchley's stock of county maps of this size, which they also purchased, being not yet (1905) exhausted.)

ARMS OF  ST. ALBANS.

[1720.]

Part III: 1794–1900.

Read at Watford, 22nd February, 1905.

1794. Cary, John. Though not divided into counties, 'Cary's New Map of England and Wales, with part of Scotland,' drawn on the meridian of Greenwich, on a scale of 5 miles to the inch (69½ British statute miles to a degree), and measuring 5 ft. 10 in. × 7 ft. 4 in., should be noted here as marking the adoption of the meridian of Greenwich in place of that of London. It was published in 81 sheets, measuring each about 7¾ × 9¾ inches, and was bound up, with a List of Places shown on the map running to about 85 pp., in a large 4to atlas, London, June 11th, 1794. Most of the sheets have this date at foot, but about a dozen are dated June 1st. The sheets are printed with a border and the title, etc., so that the whole can be mounted as one complete map, which extends to 56° 15′ North latitude, thus including Edinburgh, Stirling, and Glasgow. Great prominence is given to the roads; the main roads, as well as the county boundaries, parks, and other details, being coloured, and the map is both full of details and clear. Hertfordshire is almost entirely included in sheet 25, a very small portion of the northern border only being within sheet 34.

This large map was also reduced by Cary to one sheet, measuring 24¼ × 29½ inches, and on a scale of 15 miles to the inch. The reduction was published February 20th, 1796, and re-issued, "corrected to the Year 1805", with the title: 'Cary's Reduction of his Large Map of England and Wales, with part of Scotland.'

1795. Newcome, Peter. 19⅞ × 16. Scale, about 2¼ miles = 1 inch. Engraved by F. Vivares [20 Nov., 1794].

Shows the hundreds, rivers, roads, towns, villages, and hamlets, with the woods, parks, and hills. A well-filled map, with the details extending into the adjoining counties. The meridians are marked in the margin of the map. The title, in the left-hand top corner, runs as follows:—"A New Map of the County of Hertford, with Additions, Corrections, and Improvements. Drawn and Engraved for the Revd. Mr. Newcome's History of St. Alban's Abbey." In the right-hand bottom corner is a coarsely-engraved star-shaped indicator of the points of the compass, showing the north by an ornamental arrow-head, and the east by a cross, and a scale of miles. Below the map: "Published as the Act directs Novr. 20th. 1794, by M. Hooper No. 212 Holborn London. For the Revd. Mr. Newcome Rr. of Shenley Herts," and to the right: "F. Vivares *Sculpt.*"

From 'The History of the Ancient and Royal Foundation, called the Abbey of St. Alban, in the County of Hertford,' "By the Reverend Peter Newcome, Rector of Shenley, Herts." This work was originally published in two parts, both London, 4to, dated 1793 and 1795 respectively. The map of Herts is in the second part. The whole was subsequently issued in one

volume, with the title which appeared in the first instance with the second part. London, 1795, 4to.

*** 1795. Aikin, John.** $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles= 1 inch.

An exact reprint of the map of Herts in the second edition of 'England Delineated,' published in 1790.

From 'England Delineated,' 3rd ed. London, 1795, 8vo.

*** 1795 (c). Lodge, John.** $12\frac{3}{4} \times 10\frac{1}{4}$. Scale, 4 miles= $1\frac{1}{8}$ inch.

A reprint of the map of Herts which occurs in 'The Political Magazine' for October, 1788, with the omission of the reference and date outside the top right-hand corner, and of the publisher's imprint at the foot of the map. It is otherwise unaltered.

From an atlas of 40 maps of the English counties, preceded by three general maps of England and Wales, Scotland, and Ireland, without title or date, on thin paper, folio. There is a copy in the British Museum, and I have one in my collection. The paper of the latter has a water-mark dated 1795.

***1796. Bickham, George, junior.** $5\frac{3}{4} \times 9$. A reprint of the Bird's-Eye View Map of Hertfordshire of 1751. It is distinguishable from the original by the insertion of the words "Part of" in the foreground of the view, above the word "Middlesex," and between the two figures. Above the map: "Hertfordshire", with the number 16 on the right.

From 'A Curious Antique Collection of Bird's-Eye Views of the several Counties in England and Wales; exhibiting a Pleasing Landscape of each County; with a variety of Rustic Figures, Ruins, Etc. Etc. And the names of the Principal Towns and Villages, interspersed according to their apparent situation. Finely Engraved on Forty-six Plates. By George Bickham, Junior. . . . 1796.' London, 1796, sm. fol.

This volume consists (in the British Museum copy, the only one I have been able to examine) of a frontispiece from the earlier issues of the work (see under *George Bickham*, 1751 and 1754, *Trans.*, vol. xi, pp. 196 and 198), dated October 2nd, 1747, the title as above, an index, forty view-maps of the counties of England, two of North and South Wales, two plates of antiquities, and two giving the pay of the Navy and Army. The whole is engraved from numbered plates, and on one side of the paper only. The impressions of the views are very good, and, possibly, the original plates may have been retouched.

***1796 (c). Aikin, John.** $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles = 1 inch.

A collection of Aikin's maps, including the map of Herts, exists in the British Museum Library. It has no title, but has a manuscript date on the fly-leaf: "May 9th, 1796."

1798 (c). Stockdale, John. $19\frac{3}{8} \times 15\frac{1}{8}$. Scale, about $2\frac{1}{4}$ miles = 1 inch. Engraved by S. J. Neele.

A map of Herts in a plain, ruled border, with the degrees and minutes of latitude and longitude marked (the latter from St. Paul's, London), and showing the hundreds, rivers, main and cross roads (with the miles marked on the former), towns, villages, hamlets, houses, parks, woods, hills, and commons. In the left-hand top corner is the title: "A Map of Hartfordshire", and in the right-hand bottom corner a plain indicator of the N. and E., the former shown by an ornamental arrow-head, and the latter by a transverse line terminating in a small cross. Below this is a scale of "British Statute Miles". At the foot of the map: "Publised [*sic*] September 20th 1798 by J. Stockdale, Piccadilly."

From an atlas without title in the British Museum Library, containing a large folding plan of London dated 1797, a map of the River Thames dated 1796, "A New Map of the Country Round London", of which the date is not clear, and the following county maps: Essex, and Kent (1797), and Herts, Middlesex, and Surrey (1798). These maps are some of them signed by Neele, and were, no doubt, all engraved by him.

***1800. Aikin, John.** $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles = 1 inch. Another reprint of the map of Herts of 1790.

From 'England Delineated,' 4th ed. London, 1800, 8vo.

1801. Cary, John. $21\frac{1}{4} \times 18\frac{7}{8}$. Scale, $2\frac{1}{4}$ miles = 1 inch. A map of Hertfordshire apparently founded on the Ordnance Survey, and giving all the usual details, which do not extend, however, except here and there, beyond the borders of the county. It is a very well-filled map, and very well engraved, and is drawn on the meridian of Greenwich. The names of the principal roads are engraved on the map, as well as indications of their directions where they leave the county, e.g., "Birmingham Road", "The Glasgow R^{d}", "The Carlisle and Glasgow R^{d} by Doncaster", "The Great North Road to Edinburg". The distances in miles are marked on the roads. The title is engraved in the left-hand top corner, in a large, plain, oval, raised plaque, shaded on the edge: "A New Map of Hertfordshire, Divided into Hundreds, Exhibiting Its Roads, Rivers, Parks Etc. By John Cary Engraver 1801". In the right-hand bottom corner is a star-indicator of the north, and, below, a shaded band with scale of miles. Below the margin of the map: "London, Published by J. Cary, Engraver and Mapseller No 181 Strand Sep^{r}. 28. 1801."

From a series of county maps published in parts, of which the second contained Herts, Nottingham, and Cheshire, all dated September 28th, 1801. This 'Complete Set of County Maps' is first advertised in the second edition of 'Cary's New Itinerary,' published in 1802. A large number of the maps are dated 1801, but a few are later (1805, 1806, 1807, 1808, and 1809), and a map of England published with the set is dated June 1st, 1809. These maps were collected in an atlas in the last-mentioned year, and published under the title of 'Cary's New English Atlas,' London, 1809, large folio.

(Reprinted 1809, 1811, 1818, and 1828, and perhaps at other intermediate dates. The plates were used later by G. F. Cruchley from about 1832 up to 1875; in 1876 they were purchased by Messrs. Gall & Inglis, of Edinburgh, and were printed from by them until the end of the nineteenth century, and are still (1905) in use; see under the dates 1832, 1855, 1875, 1883, and 1885, *post.*)

1801. Smith, Charles. $20\frac{5}{16} \times 17\frac{7}{8}$. Scale, 2 miles = $\frac{5}{16}$ inch. Engraved by Jones & Smith, Pentonville.

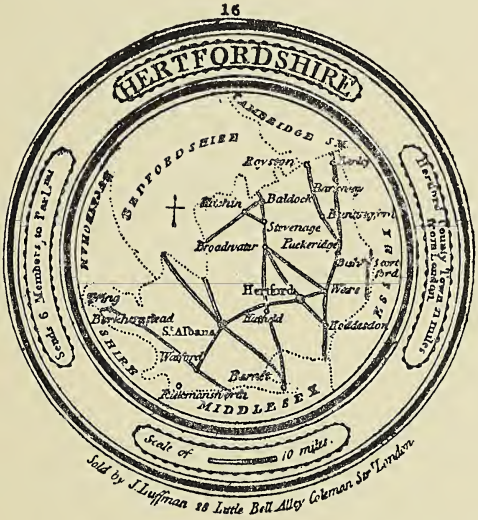
A very well-engraved and clear map of the county, giving special prominence to the principal roads. It shows the hundreds, roads, rivers, canals, towns, villages, hamlets, sites of churches, houses, parks, woods, hills, and commons, the details not being extended beyond the county boundaries. The distances in miles between towns are marked on the main roads. The margin of the map is cut by the boundary of the county both on the east side (near Bishop's Stortford) and on the west (near Tring). The degrees and minutes of latitude and longitude are marked in the margin, the map being drawn on the meridian of Greenwich Observatory, as is stated in the margin at foot. In the left-hand top corner: "A New Map of the County of Hertford Divided into Hundreds. London Printed for C. Smith, No. 172, Strand. January 6th 1801," and below, a small star-indicator of the points of the compass with, again below, "Jones & Smith, *sculp.* Pentonville." In the bottom corner, on the same side of the map, is a "Reference to the Hundreds," and, in the right-hand bottom corner, an "Explanation." At the bottom of the map, in the centre, is a scale of seven miles.

This map is one of a series of county maps all of the same date, which appear not to have been collected into an atlas until 1804. (Reprinted in 1808 (c), 1818 (c), 1821, 1827 (c), 1843 (c), and 1846 (c), with trifling alterations, and with variations in the colouring. These are all the dates I can identify, but there may have been intermediate issues. The only editions of the atlas I have been able to find are those of 1804, 1808, and 1821.)

1803. Luffman, John. A circular map with a wide border; diameter of map $1\frac{5}{8}$, and with border $2\frac{7}{16}$. Scale, about 24 miles = 1 inch. It is printed in the upper half of a 12mo page, with descriptive letterpress below, and gives the county boundary, and the boundaries of the adjoining counties up to the border of the map, and the roads and principal towns and villages. Within the map is a small, upright cross-indicator of the north. In the border, at the top: "Hertfordshire"; on the left: "Sends 6 Members to Parl^{mt}"; on the right: "Hertford County Town 21 miles from London"; and, at bottom, a "Scale of 10 miles." The map is numbered "16" at the top of the page, and has below it, outside and following the curve of the border: "Sold by J. Luffman 28 Little Bell Alley Coleman Str^{t} London." There is no text on the back.

From 'A New Pocket Atlas and Geography of England and Wales, Illustrated with Fifty-five Copper Plates. Shewing all the

Great Post Roads with the Towns and Villages situated thereon'; "By John Luffman, Geogr." London, 1803, 12mo. This little book consists of the title-page, maps and descriptions of the English counties, each on a single page, pp. 1–42, and of the Welsh counties, separately paged 1–12, with an index and small folding index-map at the end. There is a copy (the only one I have come across) in the Library of the British Museum. I have seen another impression of the map of Herts which differs only from the one above described by the number "16" being close to the margin of the map at the top, instead of being placed at the top of the page itself, i.e. a quarter of an inch higher. I have not been able to find the work in which it occurs. A facsimile reproduction of this map is given below.



*** 1803. Aikin, John.** $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles = 1 inch.

Reprinted from the plate which first appears in Aikin's 'England Delineated,' the second edition, published in 1790.

From 'England Delineated,' 5th ed. London, 1803, 8vo.

1804. Green, William. $3\frac{7}{16} \times 4\frac{13}{16}$. Scale, 10 miles = 1 inch. Set north to left hand of the page.

An outline map of Herts, giving the county boundary, the rivers, the main roads, the towns, and a few villages, hamlets, and parks. The border is of two fine, ruled lines, and the title at the foot of the page (west side of the map) is in slightly ornamental capital letters: "Hertfordshire." Within the margin of the map are, in the top right-hand corner, a plain, arrow-head indicator of the north (set to the left hand), and, in the bottom left-hand corner, a scale of 10 miles.

From 'The Picture of England, Illustrated with correct colour'd Maps of the several Counties.' By William Green, A.B. 2 vols. London, 1804, 8vo. The description and map of Hertfordshire are in Vol. I. A peculiarity of this little work is that the map of England and those of many of the counties are printed upside down. Others of the county maps are set with the north to the right or left hand of the page.

1804. Young, Arthur. $12\frac{1}{2} \times 10\frac{5}{16}$. Scale, about 3 miles = 1 inch. Engraved by S. J. Neele.

A map coloured to show the various soils of the county of Hertford, and divided into areas of chalk, clay, loam, rich loam, and poor gravel. It has little other detail, but gives a few roads, and the rivers, with the towns, some villages, and houses, and along the Chalk outcrop, here and there, ranges of hills. The border is divided into degrees and minutes of latitude and longitude (meridian of London). In the left-hand top corner, in oval panel: "Map of the Soil of Hertfordshire." Outside the margin of the map at the same corner: "To face p. 3," and below right-hand bottom corner: "S. J. Neele *Sc* Strand."

From the 'General View of the Agriculture of Hertfordshire; drawn up for the consideration of the Board of Agriculture, and Internal Improvement. By the Secretary to the Board.' London, 1804, 8vo. This is one of the numerous works on Agriculture of the celebrated Arthur Young (1741–1820).* The survey upon which it is based was made in 1801, and the notes were revised in October of that year.

The Board of Agriculture was established in 1793, with Sir John Sinclair as president, and Young as secretary.

***1804. Smith, Charles.** $20\frac{5}{16} \times 17\frac{7}{8}$. Scale, 2 miles = $\frac{1}{16}$ inch. Engraved by Jones & Smith, Pentonville.

A re-issue of Smith's large map of Herts of 1801 differently coloured, but unaltered from the impression of that year, of which it still bears the date.

From 'Smith's New English Atlas Being a Complete Set of County Maps, Divided into Hundreds.' It is "Printed for C. Smith, Mapseller, No. 172 (Corner of Surrey Street), Strand." London, 1804, imperial folio. It contains, besides a general map of England and Wales, 39 maps of the English counties, 4 of Yorkshire, and Wales in two sheets, with an *Index Villaris*, and a list of subscribers. There appears to have been a re issue of this edition of the atlas in which all the maps, except as to the imprint on two of the Yorkshire sheets, are re-dated 1804 ("January 6th 1804"). I have a copy in my collection, some of the sheets of which have a water-mark date as late as 1805. It should be the first edition of the atlas, that of 1808 being described on the title-page as the second.

* See 'The Autobiography of Arthur Young, with selections from his Correspondence.' By M. Betham-Edwards. London, 1898, 8vo.

Smith and Cary appear to have been rivals in the production of large county maps and atlases from 1801 onwards, the earliest of Cary's large maps being dated 1801, though they were not collected into an atlas till 1809. Their maps are very like one another in both style and matter.

1806. Wilkes, J. $9\frac{1}{2} \times 7\frac{1}{4}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by S. Neele.

A plainly-drawn map of Hertfordshire, in a double-ruled border, with the degrees and minutes of latitude and longitude marked (the latter from London), and showing the rivers, roads (with the distances from London in miles of the principal places on the main roads), towns, villages, and parks, with the woods and commons, but no hills; nor is the Grand Junction Canal inserted. The margin is partly broken by the design of the map in the north at Ashwell, on the east side from Bishop's Stortford to Sawbridgeworth, and in two places at the bottom (Barnet and Totteridge, and from Bushey Heath to Rickmansworth). In the left-hand top corner is a finely engraved star-indicator of the points of the compass, and below it a scale of 6 "British Miles." Below the map, in the centre, in slightly ornamented capitals: "Hertfordshire." On the left: "S. Neele *Sculpt.* 352 Strand," and, on the right: "London Published as the Act directs May 21st 1806. by J. Wilkes."

1806 (c). Cooke, George Alexander. $4\frac{3}{4} \times 4\frac{1}{4}$. Scale, 10 miles = 1 inch.

Map of Herts, following Cary's small map of 1792 in details, but drawn on the meridian of Greenwich, and set north to the right hand, in a ruled border showing the degrees and minutes of latitude and longitude. It gives the hundreds, indicated by numbers referring to a list in the margin, the principal and a few cross roads, rivers and canals, towns, and a few villages and parks. In the top margin the title "Hertfordshire," in capital letters, is set in the border in a shaded and projecting panel. In the top right-hand corner is a circular indicator of the north (turned to the right hand), and, below, a list of the hundreds. In the left-hand bottom corner is a scale of ten miles. The distances from London of the principal places, and notes of the directions of the roads where they leave the county, are inserted. At foot, below the margin: "The County Town is denoted by red, and the respective Hundreds of the County by different Colours; which distinctions are peculiar to the Superior Edition."

From 'A Topographical and Statistical Description of the County of Hertford.' London, no date, 12mo. It forms vol. viii of 'The Modern British Traveller; or, Tourist's Pocket Directory,' published by Cooke in 47 volumes between 1802 (?) and 1810 (?). This volume contains the descriptions and maps of Herefordshire, Hertfordshire, and Huntingdonshire, but separately paged. There is a water-mark on the paper of the frontispiece map in vol. i of this series in the British Museum copy, 1801, and one of 1806 on a page in vol. viii.

(This work was, it seems, more than once re-issued, with but very trifling additions on the maps. I have several odd volumes undated, but printed on paper bearing the water-mark 1822; a volume for Devon in the British Museum has on the title "Third Edition," and another for Cheshire in the same collection is described as "A new Edition," and has a frontispiece dated 1830. A "superior edition" was issued with the cities and hundreds coloured. All that can be said with any certainty as to this publication is that it was commenced not earlier than 1801, and was continued by reprints up to as late as 1830.)

***1806. Camden, William.** $19\frac{5}{8} \times 15\frac{3}{4}$. Scale, about 2 miles = 1 inch. Engraved by John Cary.

A reprint of the map of Herts in the first edition of Gough's 'Camden' (1789), with the addition, below the title, of "Published by John Stockdale Piccadilly 26th March 1805," and, on the map itself, of the Grand Junction Canal (the Act for which was obtained in 1793); and by these alterations the map can be distinguished from the earlier impression. The longitude east and west from St. Paul's, London, is retained.

From the '*Britannia*,' published by Gough & Nichols in four volumes, London, 1806, fol. The map and description of Hertfordshire are in the second volume.

***1807. Laurie, Robert, and James Whittle.** $8\frac{7}{8} \times 7\frac{1}{8}$. Scale, 5 miles = 1 inch. Engraved by B. Baker.

A map of Herts, engraved from the plate used for the map published in the 'Universal Magazine of Knowledge and Pleasure' in 1792, but with many additions. On the map itself the number of places shown and their names are nearly doubled, a few of the roads are engraved, letters (*a*, *b*, *c*, etc.) are inserted where the principal roads leave the county boundary, and the Grand Junction Canal is added. A star-indicator of the cardinal points is engraved as a background to the panel bearing the title, and below the map is added: "Published, October 13th 1806, by Laurie & Whittle, No. 53 Fleet Street London."

From 'Laurie & Whittle's New and Improved English Atlas, divided into Counties.' London, 1807, obl. 4to. This atlas contains, with interleaved list of localities, etc., 48 maps, and an engraved "Explanation Plate."

1808. Britton, John, and Edward Wedlake Brayley. $9\frac{1}{8} \times 6\frac{7}{8}$. Scale, $5\frac{1}{2}$ miles = 1 inch. Engraved by J. Roper [1805].

A map of Hertfordshire, in a ruled border, with the degrees and minutes of latitude and longitude marked, meridian of Greenwich. It shows the boundaries of the hundreds and county, the principal and a good many cross roads, with indications of their directions where the former leave the county, the distances from London of the principal places, and the distances between those places (the latter distinguished by Roman figures). The Roman roads and

stations are specially marked, as well as "Castles", "Abbies and Priories", "Encampments", and "Places where Roman Coins have been found." It also gives the rivers, Grand Junction Canal, towns, villages, hamlets, and parks. The title "Hertfordshire" is set in the top margin, in a panel shaded horizontally. At the right-hand top corner "18" in large, coarse figures. In the left-hand top corner is a table of "Explanation," and in the right-hand top corner a small, shaded star-indicator of the points of the compass. In the bottom corner, on the same side, a list of the hundreds, and below, a scale of 10 miles. In the centre of the bottom border: "Drawn and Engraved, under the direction of E. W. Brayley." Below the margin, on the left-hand side: "Engraved by J. Roper from a Drawing by G. Cole"; in the centre: "London: Publish'd for the Proprietors by Vernor & Hood, Poultry, Dec. 1. 1805"; on the right: "to accompany the Beauties of England and Wales."

From vol. vii, London, 1808, of the 'Beauties of England, Wales, [and Scotland],' published 1801–1815, 26 [or 30] vols. London, 8vo. The work has been made up in various numbers of volumes, and the maps are often bound separately. This appears to be the first publication of the Herts map, though it is dated three years earlier. It was subsequently reprinted unaltered in the 'British Atlas,' London, 1810, 4to, and, with alterations from time to time, in other publications, viz., in the 'English Topography,' 1816, and 1820 (c); in 'England and Wales Delineated,' 1843 (c); and in 'Collins' Railway and Pedestrian Atlas,' 1858 (?).

1808. Capper, Benjamin Pitts. $7 \times 4\frac{1}{16}$. Scale, 8 miles = 1 inch. Drawn and engraved by Cooper.

A map showing the hundreds, rivers, canals, roads, towns, and a few villages, with a few hills along the northern border. The river rising at Baldock and flowing into the Hiz is erroneously named the Rhea. The border, of a thick ruled line, is broken in four places along the bottom by the boundary of the county. In the right-hand top corner, in a narrow panel with the corners bevelled, the title: "Hertfordshire," and, below: "in which is laid down every Parish and Place containing upwards of 40 Houses." Below again, in a single column, a list of the hundreds, and particulars of the boroughs, market towns, parishes, inhabitants, acres, etc., and at its foot a scale of ten "British Miles." In the left-hand top corner an indicator of the cardinal points, consisting of two crossed lines, with an ornamental terminal for the north. Above the top right-hand corner: "Plate xvi"; below the map, in the centre: "Published Jan^{y} 1, 1808, by R. Phillips, Bridge Street, Blackfriars, London"; and on the right: "Cooper *del^{t}. et sculp^{t}.*"

From 'A Topographical Dictionary of the United Kingdom.' London, 1808, 8vo. It contains 46 maps, including 40 of the English counties. (Reprinted in 1813, 1826, and 1829.)

***1808 (c). Smith, Charles.** $20\frac{5}{16} \times 17\frac{7}{8}$. Scale, 2 miles = $\frac{1}{1}\frac{5}{6}$ inch. Engraved by Jones & Smith, Pentonville.

A practically unaltered reprint of Smith's map of 1801 and 1804, bearing the latter date, with the addition below of: "2nd Edition Corrected to 1808."

From 'Smith's New English Atlas,' "2nd Edition, Corrected to 1808," London, imperial folio.

1809. Hackman, Thomas. $16\frac{1}{4} \times 13\frac{7}{8}$. Scale, about $2\frac{1}{2}$ miles = 1 inch.

An outline map of the county, showing its boundaries and those of the hundreds and parishes. No towns or other particulars are given, but in a few parishes notes relating to the market day and population are inserted, e.g., Royston—"M: D: Wednı: 356 Inh:"; Ware—"M: D: Tu: 2950 Inh:". Curiously enough, Hertford itself is not mentioned. The border of the map is slightly ornamented. At the top, above the margin, in two lines, is: "Hartfordshire belongs to the Diocese of London and Province of Canterbury, is bounded on the North by Bedfordshire, and Cambridgeshire, on the East by Essex, on the West by Buckinghamshire, and on the South by Middlesex Extends in length 36 miles In breadth 28 miles and is 130 miles in circumference. The principal Town is Hartford. It contains 8 Hundreds, 18 Market Towns, 135 Parishes, 54 Vicarages, 16.500 Houses, and 97.577 Inhabitants. Sends 6 Members to Parliament, viz^{t}: for the County and Towns of Hertford and S^{t}. Albans 2 each."

In the left-hand top corner, in a large, plain oval, is the title: "Hartfordshire, divided into Hundreds and Parishes," and, in the right-hand bottom corner, a star-indicator of the points of the compass, the north inclined slightly to the right of the vertical. Below it is a "Scale of (7) Miles." Below the border, in the centre: "March the 10th: 1809. Published and Sold by Tho^{s}: Hackman Land Surveyor, Watford, Herts." The only copy I have seen of this map is one in the British Museum Library.

*** 1809. Aikin, John.** $7\frac{3}{8} \times 4\frac{1}{2}$. Scale, about 8 miles = 1 inch.

The last reprint of the map of 1790.

From 'England Delineated,' 6th ed. London, 1809, 8vo.

*** 1809. Cary, John.** $21\frac{1}{4} \times 18\frac{7}{8}$. Scale, $2\frac{1}{4}$ miles = 1 inch.

A reprint of the map of Herts published in 1801 as part of a set of County maps.

From 'Cary's New English Atlas; A Complete Set of County Maps, from Actual Surveys.' London, 1809, large fol. The maps retain their original dates. This atlas contains 42 maps, including a general map of England, one of Wales, and Yorkshire in 4 sheets. There is an index bound separately, and of the same size as the atlas, but without date. It may have been published earlier, as some of the particulars it contains are given as up to "Easter, 1803."

*** 1810. British Atlas.** $9\frac{1}{8} \times 6\frac{7}{8}$. Scale, $5\frac{1}{2}$ miles = 1 inch. Engraved by J. Roper [1805].

An unaltered reprint of the map of Hertfordshire, with the same particulars, number, imprints, and date.

From 'The British Atlas; comprising a Complete Set of County Maps, . . .' It is printed for Vernor, Hood, and Sharpe (and a number of other firms), and contains 58 maps, namely, 2 of England and Wales, 40 of the English counties, 4 of the Ridings of Yorkshire, and 12 of the Welsh counties, and 21 plans of the cities and principal towns. The two frontispiece maps of England and Wales are dated respectively September 1st and December 1st, 1809, and the county maps vary in dates between 1804 and 1809 (inclusive). This collection consists simply of the maps prepared for and issued with Britton & Brayley's 'Beauties of England and Wales.' London, 1801–15, 8vo. (*q.v. ante*, pp. 180, 181.)

1810 (?). Wallis, James. $5\frac{3}{16} \times 3\frac{13}{16}$. Scale, 10 miles = 1 inch.

A small map of Hertfordshire set north to the right hand in a double-lined border with degrees and minutes of latitude and longitude. On the left (west side) of the map is a shaded panel forming part of, but partially projecting from the border, containing the title in open capitals: "Hertfordsh." At the top left-hand corner is the number 16, very small. On the right (or east) side of the map, in a rectangular space, within the lines of the border of the map as measured above, is an "Explanation" of the signs on the map in three lines, and, below the margin, on the same side: "London, Publish'd by J. Wallis, Engraver, 77, Berwick Str., Soho."

This map gives the usual details, with special prominence to the mail-coach roads and the turnpike roads. In the left-hand top corner of the map is a small and finely-engraved star-indicator of the north, in the right-hand bottom corner a "Scale of Miles" (6), and in the bottom border: "Long. W. of Greenwh."

From 'Wallis's New Pocket Edition of the English Counties or Travellers' Companion.' London, no date, 12mo. The above date is that given in the British Museum catalogue.

(Reprinted in 1819 by William Lewis; an impression of this map also exists with the imprint: "P. Martin, No. 198 Oxford Street," but I have been unable to fix its date, or trace the atlas or topographical work in which it appeared.)

*** 1811. Cary, John.** $21\frac{1}{4} \times 18\frac{7}{8}$. Scale, $2\frac{1}{4}$ miles = 1 inch.

Another reprint of Cary's large map of Herts, first printed in 1801, dated 1811.

This map may have been published in an edition of the atlas of 1809, but I have only seen an individual example.

1813 (c). Wallis, James. $10\frac{1}{8} \times 7$. Scale, about $5\frac{1}{2}$ miles = 1 inch.

A brightly-coloured map, showing particularly the parks and roads; hills are also engraved and are rather a prominent feature.

The title: "Hertfordshire," in the left-hand top corner, is engraved on a shaded band crossing a small star-indicator of the points of the compass, with below: "Engraved by J. Wallis." A list of the hundreds, in a single column, is placed in the left-hand bottom corner. In the right-hand top corner is a "Scale of (6) Miles," and in the bottom corner on the same side is an "Explanation." A broken line of the "Meridian of London" is engraved across the map, and suggests that the original plate was engraved much earlier than the above date, but I have not been able to find any earlier impression. The imprint below the border at the foot of the map is: "London Published by S. A. Oddy, 1812."

From 'Wallis's New British Atlas,' "London. Published by S. A. Oddy, 1812." This atlas could not, however, have been actually issued before 1813, as, although a good many of the maps in the series bear the same date as the title-page, there are eight dated 1813. It appears, therefore, to be more properly described as, London, 1813 (c), 4to.

(The map was reprinted in 1819 in 'Ellis's New and Correct Atlas of England and Wales,' and again, in 1820, by "J. Phelps, No. 27 Paternoster Row, London," but I do not know in what publication this latter re-issue appeared.)

***1813. Capper, Benjamin Pitts.** $7 \times 4\frac{1}{16}$. Scale, 8 miles = 1 inch. Drawn and engraved by Cooper.

A reprint of the map of 1808, unaltered.

From another edition of 'A Topographical Dictionary of the United Kingdom.' London, 1813, 8vo. This edition has 47 maps.

1815. Clutterbuck, Robert. $10\frac{3}{4} \times 8\frac{3}{4}$. Scale, about 4 miles = 1 inch. Engraved by Thomas Leman [1814].

Outline map, with single-line border, giving boundary of the county, the rivers, and a few towns and villages, and the British trackways and posts and stations. In the right-hand bottom corner the title runs: "British Map of Herts. Thomas Leman. 1814." In the left-hand top corner is a "List of British Posts or Stations and British Trackways." Outside border, at the top right-hand corner: "Introd. p. vii."

From the first volume of Clutterbuck's 'History and Antiquities of the County of Hertford.' This work appeared in three volumes, published respectively in 1815, 1821, and 1827, all London, fol.

1815. Clutterbuck, Robert. $10\frac{3}{4} \times 8\frac{3}{4}$. Scale, about 4 miles = 1 inch. Engraved by Thomas Leman [1814].

Outline map, with single-line border, showing the boundary of the county, with the rivers, a few towns and villages, and the Roman roads and stations. In the right-hand bottom corner: "Roman Map of Herts. Thomas Leman. 1814," and, in the left-hand top corner, a "List of Roman Roads and Stations and Vicinal Roads." At the top right-hand corner, above the margin: "Introd. p. xiv."

From the first volume of the 'History and Antiquities of the County of Hertford.' London, 1815, fol.

1816. Dix, Thomas. $17\frac{7}{16} \times 14$. Scale, about 3 miles = 1 inch.

A clearly-engraved map of Herts, following Smith's large map in style, details, and colouring. It gives prominence to the main roads, showing their directions where they leave the county, and the miles between towns and from London. In the left-hand top corner is a view of Waltham Cross, with, below it: "Waltham Cross, Hertfordshire." To the right of this view, near the top of the map, is a "Reference to the Hundreds," in two columns—Braughin (*sic*), and Edwinstree (in one word). In the right-hand top corner an "Explanation," with the various signs and characters used on the map, and in the left-hand bottom corner a finely-engraved star-indicator of the points of the compass. The centre, at the bottom of the map, has a "Scale" of nine miles, and in the right-hand bottom corner the title, set in a circle, runs: "A New Map of the County of Hertford Divided into Hundreds, By Mr Thos Dix." The margin contains the degrees and minutes of latitude and longitude, and, below, in the centre, the imprint is as follows: "London. Published August 1st, 1816, by William Darton Junr. 58 Holborn Hill."

The only copy of this map with the name of Dix upon it, and dated at foot, is in the collection of Mr. Greg. It folds in a case, which is labelled: "Herts. By Thos. Dix, Surveyor, North Walsham," and: "London; William Darton, Holborn Hill." A similar map of Cambridgeshire, of the same date, and with the name of Dix on it, is in the Cambridge University Library.

(For the reprints of this map, see under date 1840 (?) and 1852 (c), *post.*)

***1816. Nightingale, Joseph.** $9\frac{1}{8} \times 6\frac{7}{8}$. Scale, $5\frac{1}{2}$ miles = 1 inch. Engraved by J. Roper [1805].

A reprint of the map of Herts in the 'Beauties of England and Wales' (vol. vii, 1808), and the 'British Atlas' (1810), retaining the imprints of the original plate.

From 'English Topography; or, Geographical, Historical, and Statistical Descriptions of the several Counties of England and Wales. Accompanied by an accurate Map of each County, from actual survey.' The preface is dated "London, October, 1816," and the work is: "London: Printed for Baldwin, Craddock, and Joy, Paternoster Row. 1816." Large 4to. The maps and descriptive text are also found bound in separate volumes of the same date, the atlas being made up of the set of 58 maps. Another issue of this work, mentioned below, with the maps interleaved with the text, may be some years later in date.

***1816 (c). Nightingale, Joseph.** $9\frac{1}{8} \times 6\frac{7}{8}$. Scale, $5\frac{1}{2}$ miles = 1 inch. Engraved by J. Roper [1805].

Another issue of the county map in the 'English Topography' of 1816, but with the imprints all erased. It is otherwise unaltered.

From another edition of the 'English Topography.' London, no date, 4to. The Preface retains the date, October, 1816, but the

work is published by James Goodwin & Thomas McLean, instead of Baldwin, Craddock, & Joy, and the date on the title-page is omitted. All the maps have had the imprints erased.

1817. Langley, Edward. 10 × 6⅞. Scale, 5½ miles = 1 inch.

A well-drawn map of the County of Hertford, with the hundreds, roads, rivers, the Grand Junction Canal, and the towns, villages, parks, and houses. The title runs along the top of the map, above the border: "Langley's new Map of Hertfordshire." In the left-hand top corner is an "Explanation," and on its right a small star-indicator with initial letters for the four cardinal points. In the left-hand bottom corner is a "Scale of Miles." In the right-hand top corner is a list of the hundreds, and, in the bottom corner on the same side, a view of St. Albans Abbey taken from the south-south-east. Below it, in the border of the map: "St. Albans Abbey." Below the margin of the map: "Printed and Published by Langley & Belch, No. 173 High Street, Borough, London, Oct. 1st 1817."

There appears to be a series of county maps published by Langley, but, in addition to the one described above, I have only seen three, viz.: Lincolnshire, dated Nov. 1st, 1817; Somersetshire, April 1st, 1817, both in the British Museum; and Cambridgeshire, in the University Library, Cambridge. I have not found any collection or atlas of Langley's county maps.

*** 1818. Cary, John.** 21¼ × 18⅞. Scale, 2¼ miles = 1 inch.

A further reprint, probably unaltered, of Cary's large map of Herts, but I have not been able to examine a copy.

From 'Cary's New English Atlas,' apparently the third edition. London, 1818, large fol.

*** 1818 (c). Cary, John.** 10$\frac{5}{16}$ × 8¼. Scale, about 4½ miles = 1 inch.

An undated reprint of Cary's map of Herts of 1793, which was itself re-engraved after the original of 1787; the imprint, however, is altered from that of the map of 1793 to: "London: Published by J. Cary Engraver and Mapseller Strand."

From an undated edition of 'Cary's New and Correct English Atlas,' which retains the original title-page of 1787 and 1793, with, at the foot: "Corrected to 1818." London, no date, large 4to.

(And see particulars of the same map, altered by the insertion of railways, as issued by G. F. Cruchley, in 1863, 1868 (?), 1872 (?), and 1875.)

*** 1818 (c). Smith, Charles.** 20$\frac{5}{16}$ × 17⅞. Scale, 2 miles = $\frac{1}{16}$ inch. Engraved by Jones & Smith, Pentonville.

Another reprint of Smith's map of Herts of 1801, 1804, and 1808, the date, January 6th, 1804, being retained, with the addition of the words "3rd Edition. Corrected to 1818." I have only seen a loose copy of the Hertfordshire map, but there may, of course, have been a re-issue of the atlas of 1804 and 1808.

*** 1819. Lewis, William.** $5\frac{3}{16} \times 3\frac{13}{16}$. Scale, 10 miles = 1 inch.

A reprint of the little map described under the date 1810 (*James Wallis*), with the imprint altered to: "London, Publish'd by W. Lewis Finch Lane."

From 'Lewis's New Traveller's Guide, or a Pocket Edition of the English Counties, Containing all the Direct and Cross Roads in England and Wales. With the Distance of each Principal Place from London.' This is a small, square, county atlas, with title, preface, contents, a list of mail-coaches, etc., and two pages of letterpress to each map. It contains a map of England and Wales, 40 maps of the English counties, and maps of North and South Wales, and is: "London. Publish'd by W. Lewis, No 21 Finch Lane Cornhill," no date, 12mo. The Preface is dated: "London: Oct. 16, 1819."

*** 1819. Cary, John.** $3\frac{11}{16} \times 4\frac{7}{8}$. Scale, 10 miles = 1 inch.

A copy of Cary's smallest map of the county, re-engraved after the original of 1792, but with slight variations and additions throughout, the spelling of the names of the places having been altered, and "G^{d}. Junction Canal" substituted for "Braunston Canal." In the details at the foot, the distances between towns have been altered also in a good many cases, e.g., "London to Bishops Stortford 29 M" (1792), "30 M" (1819); "Buntingford 32" (1792), "31" (1819). The imprint at foot runs: "London. Published Jan 1 1819 by J. Cary Engraver No. 181 Strand."

From 'Cary's Traveller's Companion.' London, 1819, 8vo.

*** 1819. Ellis's New and Correct Atlas of England and Wales.** $10\frac{1}{8} \times 7$. Scale, about $5\frac{1}{2}$ miles = 1 inch. Engraved by James Wallis.

A reprint of the map of Herts catalogued under the date 1813, unaltered except for the omission of the imprint.

From 'Ellis's New and Correct Atlas of England and Wales, being An Entire New Set of County Maps, ...' London, no date, 4to. The Preface is dated July 1st, 1819. Three of the maps in this atlas (Berks, Cornwall, and Lancashire) have at the top, above the border: "Second Edition, with Considerable Improvements and Additions, by G. Hebert, Geographer." These and others of the maps have the longitude of Greenwich, though Herts and some others retain that of London.

1819 [1820]. Dugdale, James. $9\frac{7}{8} \times 7\frac{3}{4}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Neele.

A well-filled map of the county, with the usual details, and the range of chalk hills strongly shaded in the north. In the left-hand top corner, in a long, shaded panel: "Hertfordshire," and, below, a scale of (6) "British Statute Miles." In the right-hand bottom corner, near the border of the county, a star-indicator of the points of the compass. In the bottom margin, on the left: "Long. W. from S^{t} Paul's, London," and, on the right: "Longitude E. from

St Paul's, London." Below the map, in the centre: "Published by J. & J. Cundee, Albion Press, London, January 1, 1815," and, on the right: "Neele, Sculpt. Strand."

From vol. iii of 'The New British Traveller, or Modern Panorama of England and Wales.' By James Dugdale, LL.D. London, 4 vols., 1819, 4to. This work contains 50 plates, dated variously 1814, 1817, 1818, 1819, and 1820, and 45 maps (1 large folding map of England and Wales, 39 maps of the English counties, 3 of the Ridings of Yorkshire, and 2 of North and South Wales). The maps are all engraved by Neele, and are dated 1812, 1814 (published by James Cundee), 1814 and 1815 (published by J. & J. Cundee), and 1818 (published by J. Robins & Co.). In each year of publication some of the maps are drawn upon the meridian of London and some on the meridian of Greenwich. That of Herts is the only one on which St. Paul's is mentioned. These maps seem, however, to be all of one series, and I am not aware that they were ever published except in the above work. As there are plates dated 1820 in both the third and fourth volumes, these volumes, though dated 1819 on their title-pages, could not have actually been issued earlier than 1820. In the advertisement, at the end of vol. iv, it is stated that the work is: "To be completed in about 16 Quarto parts, price 8*s.* each."

1820 (c). Leigh, Samuel. $2\frac{7}{8} \times 4\frac{3}{4}$. Scale, 10 miles = $\frac{7}{8}$ inch. Engraved by Sidney Hall.

A finely-engraved and well-filled map of the county, set with the north to the left hand, in a plain-ruled border, with a raised panel at the top containing the title "Hertfordshire." It shows the rivers, canals, roads, towns, villages, and parks. In the left-hand top corner of the map is a rather large and finely shaded star-indicator of the points of the compass, and, in the right-hand bottom corner, a scale of (15) "English Miles." The border is broken in one place, at the top of the map, by the words: "To Huntingdon." Outside the border, to the right of the title, the figure "16," and, below the map, as set in the page, in the left-hand corner: "Pub. by S. Leigh, 18, Strand," and, on the right: "Sidy. Hall *sculpt.*"

From a separate atlas of county maps issued with 'Leigh's New Picture of England and Wales,' London, 1820, 12mo. This work itself contains a general map of England and Wales only. In the Introduction it is stated that "the proprietor has availed himself of the talents of Mr. Sidney Hall to project a series of correct County Maps, the same size as this work, which may be had in a separate Volume, with a complete Index of the Towns, Villages, Etc." There are 55 maps in this series. On the title-page of 'Leigh's New Pocket Road-Book of England and Wales, and part of Scotland' (which appears to be an issue of the work first appearing under the title of the 'New Picture of England and Wales'), in the various editions which I have seen, the price is given as "8*s.* B.d. with 55 County Maps, 12*s.* B.d.," and amongst the

advertisements at the end of the 'New Pocket Road-Book' of 1825 is: "'The New Picture of England and Wales,' with Fifty-five Maps of the Counties. Price 1£. bound."

Copies of the Road-Book are found in the British Museum, dated 1825, 1831 (third edition), 1837 (sixth edition), and 1839 (seventh edition), and there may have been several issues of the set of maps to match the various editions of the Road-Book. The only one I have seen, however, is a copy in my library, dated 1842 (see *post*, p. 208).

*** 1820. Phelps, J.** $10\frac{1}{8} \times 7$. Scale, about $5\frac{1}{2}$ miles = 1 inch.

An unaltered reprint of the map of Herts which bears date 1812, and appears to have been first published in 'Wallis's New British Atlas' (1813 c) and afterwards in 'Ellis's New and Correct Atlas of England and Wales' (1819). The only impression of the map as dated above which I have examined is one in the Herts County Museum. It has the imprint at foot: "Printed and Published by J. Phelps, No 27 Paternoster Row, London. 1820."

*** 1820 (c). Nightingale, Joseph.** $9\frac{1}{8} \times 6\frac{7}{8}$. Scale, $5\frac{1}{2}$ miles = 1 inch. Engraved by J. Roper [1805].

A further reprint of the map from the 'Beauties of England and Wales,' unaltered except for the omission of all the imprints at foot.

From another copy of the 'English Topography' of the Rev. Joseph Nightingale, with the maps and text interleaved in one volume. It contains the original preface dated 1816, but has no date on the title-page, and is published by James Goodwin & Thomas McLean. The above date is problematic, but this issue was, no doubt, not earlier than 1818. It may, of course, have been much later.

*** 1821. Smith, Charles.** $20_{1\frac{5}{6}} \times 17\frac{7}{8}$. Scale, 2 miles = $\frac{1}{1\frac{5}{6}}$ inch. Engraved by Jones & Smith, Pentonville.

Another impression of Smith's map of Herts of 1801, 1804, and later dates, identical in details with the re-issue of 1818, except for the addition of the following roads extending beyond the boundary of the county:—The Icknield Way continued from near Hexton, through Dunstable, to the neighbourhood of Tring, with the villages of Ivinghoe and Leagrove inserted upon it; the Bedford Road continued north from Luton as far as Barton; from Edgware, which is inserted in the south of the map, roads shown to Rickmansworth, Watford, and Elstree, and with: "Corrected to 1821," under the title, in lieu of the date and the words "3rd Edition. Corrected to 1818," which appear on the map of that issue. The imprint under the star-indicator is omitted in this and later impressions of the map.

From 'Smith's New English Atlas,' with the title apparently unaltered from that of the atlas of 1804, "Printed for C. Smith, Mapseller extraordinary to His Majesty. No 172 Strand 1821."

London, 1821, imperial folio. The only copy of this edition of the atlas which I have seen is one in the library of the Union Club, Trafalgar Square, London.

1822. Bryant, A. 61 × 50. Scale, 1½ miles = 1 inch. Engraved by Davies.

A large wall-map of the county, very plainly and legibly drawn, and not overcrowded with details. It shows the boundaries of the hundreds and parishes, with the towns, villages, houses, windmills, and other details, as well as the roads, parks, woods, hills, marshy ground, etc. The degrees, minutes, and seconds of latitude and longitude are marked in the margin. In the left-hand top corner: "Map of the County of Hertford, From actual survey by A. Bryant. In the years 1820 and 1821. Inscribed by permission to the Most Noble the Marquis of Salisbury, K.G. Lord Lieutenant And to the Nobility, Clergy, and Gentry of the County. London Published by A. Bryant; 27, Gr^t Ormond Street, April 10th. 1822. Davies *scu'p.* 10 Compton Str. Bruns^k Square." In the right-hand top corner is a large, shaded, star-indicator of the north, and, in the bottom corner on the same side, an "Explanation," and, below, a scale of "Statute miles." At the foot, towards the right-hand corner of the map, in the margin: "London. April 10, 1822: Published by A. Bryant, 27 G^t Ormond Street."

Bryant published between 1822 and 1835 maps of the following counties:— Beds, Bucks, Chester, Gloucester, Hereford, Herts, Lincoln, Norfolk, Northants, Oxford, Suffolk, Surrey, and the East Riding of Yorkshire.

*** 1822 (c). Cooke, George Alexander.** 4¾ × 4¼. Scale, 10 miles = 1 inch.

There appears to have been a reprint of the map of Herts published between 1802 and 1810, in 'The Modern British Traveller,' about the above date, but I have not actually identified a copy.

Assumed to have been published in vol. viii of a [second] edition of Cooke's 'Modern British Traveller,' entitled 'A Topographical and Statistical Description of the County of Hertford.' London, no date, 12mo. I have volumes for Hereford, Warwick, and Somerset, in this series, all of which are printed on paper water-marked 1822.

*** 1824 (?). Cary, John.** 3 1/16 × 4⅞. Scale, 10 miles = 1 inch.

A reprint of the map described under date 1819 (*ante*, p. 187). It differs only in the imprint at foot, which is now: "London. Published by G. & J. Cary, No 86 S^t Jame's Str."

From 'Cary's Traveller's Companion,' an edition assumed to have been published (London, 8vo) about the above date, but I have only seen a single map of Herts, and not the work itself. On referring to the 'Itinerary' it appears that the last edition published by John Cary was the 8th, dated 1819; the 9th edition was issued

by G. & J. Cary, August, 1821, and their imprint appears on the subsequent edition. All that can be said, therefore, with any certainty, of the date of the above-mentioned map, is that it was probably published not earlier than 1821.

1825. Pinnock, William. $6\frac{3}{8} \times 5\frac{1}{8}$. Scale, 7 miles = 1 inch. Engraved by Neele & Son.

Map of Herts in a plain, ruled border, without meridians, with the usual details, including (as shown in the "Explanation") the county and market towns, the villages, the gentlemen's seats, mail-coach and turnpike roads, and canals. The miles from London are marked in figures on the main roads. In the left-hand top corner, on a shaded panel, the title, thus: "Hertfordsh." In the right hand top corner a small star-indicator of the cardinal points, in the bottom corner on the same side, a "Scale of (10) Statute Miles," and on the left side of the map, against the margin, an "Explanation" of the signs, etc., used. At the foot: "Neele & Son, *sc.* Strand."

From 'Pinnock's History and Topography of England and Wales,' 6 vols., London, 1825, 12mo. The map of Herts occurs in vol. ii of this work. The accounts of the different counties appear to have been issued successively in parts, commencing with Beds, in 1819, under a sub-title for the first two numbers of 'Pinnock's County Catechisms.' The third number (Bucks, which is not dated) and those following taking the title: 'Pinnock's County Histories.' The original issue for Hertfordshire may therefore have been earlier by a year or two than 1825. The sub-title of the Herts part, which is the last in the volume, is undated and runs: 'The History and Topography of Hertfordshire, with Biographical Sketches, Etc. and a neat Map of the County.'

1825 (?). Miller, R. $4\frac{3}{16} \times 2\frac{3}{4}$. Scale, about 11 miles = 1 inch.

Map of Herts in a double-lined border, marked with degrees and minutes of latitude and longitude (the latter on the meridian of London). It shows the county boundary, the principal roads, the rivers, with towns and a few villages, and parks. In the left-hand top corner, on a shaded band with the angles bevelled, in slightly ornamented letters: "Hertfordshire." In the right-hand bottom corner, a very small arrow-shaped indicator of the north, and, immediately below it, a scale of 10 miles. At the same corner the figure 6. At the foot, below the margin: "London, Published by R. Miller, 24, Old Fish Street."

From 'Miller's New Miniature Atlas, containing a complete set of County Maps, in which are Carefully Delineated All the Principal Direct and Cross Roads, Cities, Towns, Villages, Parks, Seats, Rivers and Navigable Canals, with a General Map of England and Wales.' London, no date, 12mo. This collection contains 56 maps, of which 52 are of counties. Some of the maps are drawn on the meridian of London, and others on the meridian of Greenwich.

1825 (?). Pocket Tourist and English Atlas. $2\frac{5}{16} \times 3\frac{3}{8}$. Scale, about 16 miles = 1 inch.

A map of the county in an ornamental border, set north to the right hand, with, at the top, in the border, in a plain panel projecting slightly within the map: "Hertfordshire," in plain capitals. At the foot of the map, in a similar panel wider than the border: "This County contains 302,080 Acres 170 Parishes 19 Market T. 111,654 Inhabitants and sends 6 Mem. to Parliament." The map itself shows the principal roads, rivers, towns, a few villages, and the parks. In the right-hand top corner is a very small arrow-head indicator of the north, and, in the left-hand bottom corner, a scale of 10 miles.

From 'The Pocket Tourist and English Atlas, being A New and Complete Set of County Maps.' It is "London: Printed for O. Hodgson. Maiden Lane Wood S^{t}". No date, 16mo. This very small set of maps contains one of England and Wales, 40 of the English counties, and one of North and one of South Wales. The copy of this atlas in the British Museum has no letterpress description, though the title-page promises "a copious Topographical Account of each County." The above date is as given in the catalogue of the British Museum Library, but, as the population of 1811 is given on the maps, it is probable that the atlas appeared at an earlier date than 1825.

1826. Chauncy, Sir Henry. $18\frac{1}{2} \times 14\frac{1}{2}$. Scale, about 2 miles = 1 inch. Drawn by C. S. Tyler, after Moll.

A rather weak and poor copy of Herman Moll's map of 1700, and slightly smaller than the original. Below the border, at the foot of the map on the left hand: "Drawn on Stone from the Original Engraving by C. S. Tyler," and, on the right: "Published by J. M. Mullinger Bishops Stortford, 1826."

From vol. ii of the reprint of Chauncy's 'Historical Antiquities of Hertfordshire.' 2 vols. J. M. Mullinger, Bishop's Stortford, 1826, large 8vo.

*** 1826. Capper, Benjamin Pitts.** $7 \times 4\frac{1}{16}$. Scale, 8 miles = 1 inch. Drawn and engraved by Cooper.

A further reprint of the map of Herts of 1808, with alterations in some of the figures of population, etc., to bring them up to date. The imprint at foot is altered to: "Published by G. and W. B. Whittaker 13, Ave Maria Lane, 1824." The engraver's name is omitted.

From 'A Topographical Dictionary of the United Kingdom.' London, 1826, 8vo. This appears to be the third edition of this work.

1826 (c). Pigot, James, & Co. $14 \times 8\frac{15}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Pigot & Son.

A map of Herts, of which this is believed to be the first impression, but I have not seen a copy earlier than that of about 1834. (See *post*, p. 201, for description.)

From 'Pigot & Co.'s London and Provincial New Commercial Directory, For 1826–7.' Third edition. London and Manchester, no date, large 8vo. In the Preface: "The Volume is embellished with a new series of Elegant Maps of the above-named Counties, engraved expressly for the Work, with highly-finished Vignettes." The first edition of this publication appeared in 1822–3, but without maps, and it is assumed that the above (third) edition was the first issued with the county maps.

(Reprinted in 1832 (c), 1834 (c), 1839 (c), and, possibly, at some intermediate date, in Pigot's Directory, and in an atlas, under the titles 'British Atlas' and 'New British Atlas,' in 1838 and 1854.)

1827. Clutterbuck, Robert. 21 × 16⅞. Scale, about 2¼ miles = 1 inch. Engraved by I. Cross.

A map of the county showing in detail the principal and cross roads (which are, in fact, the most prominent features), as well as the rivers, towns, villages, hamlets, houses, parks, and churches. It is in a rather wide and darkly-engraved border, with the degrees and minutes of latitude and longitude shown. In the left-hand top corner: "A Map of the County of Hertford," with, below, an arrow-head indicator of the north. In the bottom corner on the same side of the map is a "Scale of (10) Statute Miles." Below the margin in the centre: "London. Published 1st June 1827 by I. B. Nichols & Son, Printers, 25 Parliament Street, Westminster," and, on the right: "Engraved by I. Cross, 18 Holborn Hill."

From the third volume of Clutterbuck's 'History and Antiquities of the County of Hertford.' London, 1827, fol. The previous volumes were issued in 1815 and 1821 respectively.

*** 1827 (c). Smith, Charles.** 20$\frac{5}{16}$ × 17⅞. Scale, 2 miles = $\frac{5}{16}$ inch. Engraved by Jones & Smith, Pentonville.

Another reprint of Smith's map of Herts of 1801 and 1804, following that of 1821, but "Corrected to 1827."

Probably from an atlas of this date, but I have not been able to find a copy.

*** 1828. Cary, John.** 21¼ × 18⅞. Scale, 2¼ miles = 1 inch.

Another unaltered impression of the map of Herts of 1801, with the date 1828 inserted. An imprint at the foot of the map is: "London Published by J. Cary Engraver and Mapseller No. 86 St James's Street Jany 1st 1828." I have notes of large maps of Devon, Gloucestershire, and Salop, by Cary, of this date, and there was, no doubt, an issue of his 'New English Atlas' of 1828, but I have not seen a copy.

*** 1829. Capper, Benjamin Pitts.** 7 × 4$\frac{1}{16}$. Scale, 8 miles = 1 inch. Drawn and engraved by Cooper.

A reprint of the Hertfordshire map of 1808, as altered and redated 1824, and published in the 'Topographical Dictionary' of 1826.

From 'A Topographical Dictionary of the United Kingdom.' London, 1829, 8vo. This issue is described on the title-page as a "New Edition."

1829 (c). Teesdale, Henry & Co. $16\frac{5}{16} \times 13\frac{5}{16}$. Scale, about 3 miles = 1 inch.

A very well-engraved and clear map of the county in a ruled border, broken at two points on the east side, and with the meridians marked. It shows the hundreds, and the main roads, with miles between the principal towns and those of the towns from London, in figures, as well as indications of their directions where they leave the county; also most of the cross roads, the rivers, canals, towns, villages, hamlets, and parks, and the sites of churches. Woods are also represented by groups of trees, and hills are slightly shaded. In the left-hand top corner, in ornamental capitals: "Hertfordshire." To the right of this title, a star-indicator of the points of the compass; in the left-hand bottom corner, a scale of 8 miles, and in the right-hand bottom corner a "Reference to the Hundreds," and an "Explanation." Below the map, in the centre: "London, Published by Henry Teesdale & Co. 302, Holborn." Some of the details of this map are altogether out of date, e.g. "Odsey Course."

From the 'New British Atlas,' London, no date, 4to. A copy in the British Museum is described on the title-page as "The whole carefully revised and corrected to the year 1829." There are water-marks on the paper of various maps in this copy, of 1828 and 1829. It seems as if there may have been an earlier issue of this atlas, but I have not been able to obtain any trace of one. A new road replacing and shortening the main road between Chipping Barnet and South Mimms, fully engraved on the map when reprinted 1840 (c), is only indicated here by a thin coloured line put in roughly by hand. There is no sign of a branch canal from Rickmansworth to St. Albans which appears on another copy in the collection of Mr. Greg.

*** 1830 (c). Cooke, George Alexander.** $4\frac{3}{4} \times 4\frac{1}{4}$. Scale, 10 miles = 1 inch.

A map of Herts, reprinted from the plate of 1806 (c), as subsequently slightly altered, probably appeared about this date in an edition of 'The Modern British Traveller,' but I have not seen a copy. That the whole series of County Histories making up this work was reprinted about this time is supported by a volume for Devonshire in the British Museum, described on the title-page as the 'Third Edition,' and another volume (Cheshire), described as "A New Edition," and dated on the frontispiece 1830.

1831. Murray, T. L. $18\frac{1}{16} \times 14\frac{1}{8}$. Scale, about 3 miles = 1 inch. Engraved by Hoare & Reeves.

A well-engraved and clear map of the county, in a narrow, double-ruled border, in which the degrees and minutes of latitude and longitude are marked.

It shows the hundreds, rivers, roads (with the miles marked upon them upon the main lines, and the directions they take where they leave the county indicated), with towns, villages and hamlets, and parks and woods, and hill-shading. In the left-hand top corner is the title, in ornamental capitals: "Hertfordshire." Below it, a "Reference to the Hundreds," and, towards the bottom of the map, against the left-hand margin, a star-indicator of the points of the compass. Below this again, close to the bottom border, is a scale of 10 miles, and, in the right-hand bottom corner, an "Explanation," showing the signs used on the map.

Outside the border, at the foot of the map, is, on the left: "Drawn under the Superintendance of T. L. Murray"; in the centre: "London, Published May, 1st 1831, by T. L. Murray, 19, Adam Street Adelphi," and, on the right: "Hoare & Reeves *sc.*"

From 'An Atlas of the English Counties Divided into Hundreds Etc. . . . . Projected on the Basis of the Trigonometrical Survey By Order of the Hon^ble^ The Board of Ordnance.' London, 1831, large 4to. There are 44 maps in this collection.

1831. Lewis, Samuel. 9 × 6⅞. Scale, about 5 miles = 1 inch. Drawn on steel by R. Creighton.

A map of Herts in a double-lined margin, with degrees and minutes of latitude and longitude marked. It is very clearly engraved, and shows the main and some cross roads (with indications of direction where they quit the county), rivers, the Grand Junction Canal and Aylesbury Branch, and the Lea Navigation, with the towns, villages, and a few hamlets. Hills are shown, by shading, along the Chalk escarpment. The design does not extend beyond the boundary of the county. In the left-hand top corner the title: "Hertfordshire," with, below it, an ornamental star-indicator of the points of the compass. In the right-hand bottom corner is a "Scale of Miles" (15), and, below the margin, at the foot, on the left: "Drawn by R. Creighton"; in the centre: "Drawn and Engraved for Lewis' Topographical Dictionary"; and, on the right: "Engraved by J. & C. Walker."

From 'A Topographical Dictionary of England.' By Samuel Lewis. 4 vols., London, 1831, 4to. Herts is in vol. ii. This is the first edition of this work, of which there were seven in all. The county maps are in some cases inserted interleaved with the text, and in others bound in a separate atlas. They were slightly altered in the successive editions by the insertion of railways. This work in its most complete form (1840) was made up to 14 volumes, viz., England, 4; Wales, 2; Scotland, 2; Ireland, 2; atlases, 4. The dates of the several editions are 1831, 1833, 1835, 1840, 1842, 1845, and 1849.

1832. Boundary Commissioners. About 13 × 11½. Scale, about 4½ miles = 1 inch.

Outline map of the county, without border, to show the alterations in the Parliamentary representation proposed in the Reform Bill of this year. It gives a few roads, and towns and villages,

with the boundaries of the county, and hundreds. In the left-hand top corner: "Hertfordshire", with, below: "Population in 1831, 143,300. Assessed taxes 1830, £47,158," and a scale of miles, and, below this again: "R. Martin, 124 High Holborn and 51 Carey St." In the right-hand top corner is a very slight arrow-head indicator of the north, and, in the bottom corner on the same side of the map: "Explanations" of the signs and colours on the map, indicating (1) the boundaries of hundreds, (2) the principal places of county election, and (3) the borough towns to return two members, viz. St. Albans and Hertford. Below these indications is an engraved signature: "Robt K. Dawson Lieut. R.E."

From the Report of the Commissioners appointed in anticipation of the Reform Bill of 1832.

*** 1832. Boundary Commissioners.** About $13 \times 11\frac{1}{2}$. Scale, about $4\frac{1}{2}$ miles = 1 inch.

A reprint of the map of the same year, prepared in anticipation of the Reform Bill, 1832, with the single trifling alteration that the population, etc., of the county is re-written in italic letters.

From a further Report on the Proposed Divisions of Counties mentioned in Schedule F 2 of the Bill.

*** 1832. Reform Act, 1832.** About $13 \times 11\frac{1}{2}$. Scale, about $4\frac{1}{2}$ miles = 1 inch.

A further reprint of the map of Hertfordshire of this date issued prior to the introduction of the Reform Bill of 1832, altered by the omission of the line drawn under the scale of miles, the addition of a number (77) in the right-hand top corner, and the indication of "Polling Places" inserted in the "Explanations" and on the map at Stevenage, Buntingford, Hemel Hempstead, Hertford, Hoddesdon, and Hatfield.

From 'Plans of the Cities and Boroughs of England and Wales: shewing their Boundaries as established by the Boundaries' Act, passed 11th July, 1832: together with Outline Maps, shewing the Divisions of the Counties, the principal places of Election, and the Polling Places, as established by the same Act.' 2 vols., London, 1832, large folio. The map of Herts is in vol. i.

1832. Gorton, John. $9\frac{11}{16} \times 7\frac{9}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Sidney Hall [October, 1830].

A clearly-engraved map of the county, showing the usual details, with the roads and parks specially distinct, divided into hundreds. It gives the Grand Junction Canal and New River, but no railways. The distances from London of the principal towns are shown in miles, and where the main roads leave the county indications are given of their directions. The map is set in a double-ruled border, with the degrees and minutes of latitude and longitude marked. This border is broken in two places at the top of the map, and once each on the left side and at the bottom. In the left-hand top corner the title: "Hertfordshire", in ornamental capitals, is engraved in a rectangular panel. Below it: "Engraved by Sidy Hall." Again

below, a scale of 8 "English Miles." In the right-hand bottom corner is a "Reference to the Hundreds", with a slight arrow-head indicator of the north above it. In the bottom margin: "Longitude West from Greenwich. Longitude East." Below the border, in the centre: "London, Published by Chapman & Hall, No. 168 (*sic*) Strand, Oct^{r} 1830."

From 'A Topographical Dictionary of Great Britain and Ireland,' by John Gorton, "with fifty-four quarto maps, drawn and engraved by Sidney Hall." London, 1831–33, 8vo. The first volume of this edition is dated 1831, and the second, in which the map of Herts occurs, 1832, the third 1833.

The same maps were issued singly to fold at "1^{s} 6^{d} each mounted in a Case," by the same publishers, under the title: 'Pocket County Maps,' whether earlier than the publication of Gorton's Dictionary or not I am unable to say.

(Re-issued in another edition of the Dictionary, in which all the volumes are dated 1833, and in an atlas in 1833, 1836, and 1845, and possibly at other dates.)

1832. Tymms, Samuel. 5 × 3. Scale, about 12 miles = 1 inch.

Outline map, in double-lined border, showing towns, villages, principal roads (with distances in miles from London and from Hertford), rivers, and parks. In the left-hand top corner: "Hertfordshire," and, below, indicator of north. Above the map, along the top margin, is: "The figures affixed to the Towns show their distances from London and Hertford," and below the map: "London. Published Nov^{r} 1st, 1831, by B. Nichols & Son, 25 Parliament Str^{t}."

From vol. i (1832) of 'The Family Topographer: being a compendious account of the antient and present state of the Counties of England.' 7 vols. London, 1832–1843, sm. 8vo.

1832. Cobbett, William. $3\frac{15}{16} \times 6\frac{3}{4}$. Scale, about 8 miles = 1 inch.

An outline map of the county, very much elongated from S.W. to N.E., in a ruled border, and set with the N.E. at the top of the plate. It shows only the boundary of the county, and "the local situations of the Cities, Boroughs, and Market towns." In the left-hand top corner is an indicator of the points of the compass, in the bottom corner on the same side of the map, in a long panel: "Hertfordshire," and below the map: "Drawn and Engraved for Cobbett's Geographical Dictionary of England and Wales."

From 'A Geographical Dictionary of England and Wales,' by William Cobbett, London, 1832, 8vo, which contains an outline map of England, showing the county divisions, and 40 maps of the English counties, followed by maps of South and North Wales, with the counties and principal towns shown.

***1832 (c). Pigot, James, & Co.** 14 × $8\frac{15}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Pigot & Son.

Probably the second reprint of the map referred to under date 1826 (c), at p. 192 *ante*, and fully described at p. 201 *post*. The first reprint may have appeared about 1829 in a fourth edition of the Directory, but I have not seen the maps in either the fourth or fifth editions.

From 'Pigot & Co.'s National London and Provincial Commercial Directory, for 1832–3–4.' Fifth edition. London and Manchester, no date, large 8vo.

1832 (c ?). Cruchley, George Frederick. $21\frac{1}{4} \times 18\frac{7}{8}$. Scale, $2\frac{1}{4}$ miles = 1 inch. Engraved by John Cary.

A map of the county unaltered from Cary's reprint of his large map of 1828. It still bears this date, and has the same imprint at foot, which, however, is covered by a strip pasted over it, and bearing: "Sold by G. Cruchley, Map Seller and Publisher, 38, Ludgate Street, S^{t} Pauls, London. Engraving and Printing in all its various Branches."

The above date is somewhat problematic. It appears that Cruchley was in business as a map publisher as early as 1832, and was in possession of the three sets of Cary's plates of English county maps, from some of which, at all events, he continued to print at intervals until 1875. In the following year the plates and stock-in-trade were disposed of to Messrs. Gall & Inglis, of Edinburgh.

1833. Bell, James. $9\frac{3}{8} \times 7\frac{7}{16}$. Scale, about $4\frac{1}{2}$ miles = 1 inch. Engraved on steel by Gray & Son.

A well-filled map in a double-ruled border, with the longitude and latitude marked in degrees and minutes, and broken at the top, bottom, and left-hand side of the map. It contains all the usual details, the hills of the main line of the Chalk outcrop and the parks being shaded. In the top left-hand corner is a view of St. Albans Abbey,* entitled "S^{t} Alban's Abbey Church," and, below it, a scale of 8 "English Miles." In the right-hand top corner an arrow-head indicator of the points of the compass, and, in the bottom corner on the same side of the map, a "Reference to the Hundreds" in two columns, and, below the title: "Hertfordshire", in ornamental capitals. Below the map, in the centre: "Published by Arch^{d} Fullarton & Co. Glasgow," and, on the right: "Eng^{d} on Steel by Gray & Son."

From 'A New and Comprehensive Gazetteer of England and Wales.' By James Bell. 4 vols. Glasgow, 1833–4, 8vo. This work was originally published in eight parts. The Preface is dated August, 1832. It is "Illustrated by a series of Maps, forming a Complete County Atlas of England." Herts is in part 2 (vol. i).

(Reprinted in 1836 in a re-issue of the 'Comprehensive Gazetteer', in 1840 and 1843, and, probably at some later date, in the 'Parliamentary Gazetteer,' and, in 1884, in 'Nonconformity

* This will be reproduced in facsimile as the tailpiece to Part III, *post*.

in Herts.' There should also be a reprint in the '50's, upon which Urwick's reprint of 1884 was based.)

*** 1833. Gorton, John.** $9\frac{11}{16} \times 7\frac{9}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Sidney Hall [October, 1830]. A reprint of Hall's map described under date 1832, unaltered.

From 'A Topographical Dictionary of Great Britain and Ireland,' by John Gorton. 3 vols. London, 1833, 8vo.

*** 1833. Lewis, Samuel.** $9 \times 6\frac{7}{8}$. Scale, about 5 miles = 1 inch. Drawn on steel by R. Creighton.

A reprint of the map of 1831, with the addition above the map of: "Place of Election—Hertford. Polling Places—Buntingford, Bishop's Stortford, Hertford, Hoddesdon, Hatfield, Hemel Hempstead, Stevenage," and, on the map, a fine dotted line, with the indication: "Intended Railroad from Birmingham to London."

From 'A Topographical Dictionary of England.' By Samuel Lewis. 4 vols. London, 1833, 4to. This is the second edition.

*** 1833. Hall, Sidney.** $9\frac{11}{16} \times 7\frac{9}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. [Engraved October, 1830.]

A reprint of Hall's map of Herts, unaltered from the impression in Gorton's 'Topographical Dictionary,' except that the imprint is now: "London, Published by Chapman & Hall, No. 186, Strand, 1833."

From 'A New British Atlas; comprising a Series of 54 Maps, Constructed from the most Recent Surveys and Engraved by Sidney Hall.' London, 1833, 4to. This atlas has two pages of descriptive text interleaved with each map. All the maps have the date 1833.

1834. Greenwood, C. & J. $28\frac{3}{4} \times 23$. Scale, about 3 miles = 1 inch. Engraved by John and Charles Walker and J. Walsh.

A small, brightly-coloured map of the county in the centre of a large plate. The borders of the neighbouring counties are coloured, the principal roads are extended to some distance beyond the county boundaries, and the neighbouring county and other important towns are shown.

The hundreds are separately coloured. The main roads and parks are also coloured, and the distances in miles and in some cases their directions where they leave the county are inserted. The map is very clear, and well engraved. It has a wide engraved border, with the degrees and minutes of latitude and longitude engraved in it. The title, in the top left-hand corner, is: "Map of the County of Hertford, from an Actual Survey made in the Years 1830 and 1831. By C. & J. Greenwood. Published by the Proprietors, Greenwood & Co. 3, Burleigh Str^{t} Strand, London. Corrected to the present period, and Published April 1st 1834. Engraved by J. & C. Walker."

On the left side of the map is a list of the polling-places, etc., and in the left-hand bottom corner an "Explanation" of the signs,

and characters on the map. In the right-hand top corner a list of the eight hundreds is given, on the right side of the map is a large star-indicator of the points of the compass, and in the right-hand bottom corner is a view of St. Albans Abbey from the south side, engraved by J. Walsh. In the centre, below the map itself, a "Scale of (10) Miles" is engraved, and, below it: "Hertfordshire contains 523 Square Statute Miles."

From the 'Atlas of the Counties of England, from Actual Surveys made from the Years 1817 to 1833, by C. & J. Greenwood.' London, 1834, large folio.

This atlas, besides the engraved title-page, with a sketch-map of England and Wales, coloured to show the counties, contains 38 maps of the counties of England, 3 maps of the Ridings of Yorks, a map of Monmouth, and 4 maps of Wales in divisions, in all 46 large maps, on a uniform scale of about 3 miles to the inch. Each map is illustrated by a marginal view of a cathedral or other principal building in the county, and they are all coloured to show the hundred and other divisions, the principal roads, and the parks. Herts is number 15 in the series.

Messrs. Greenwood projected a complete series of county maps on a scale of an inch to a mile, generally on 4 or 6 sheets, at the price (with two or three exceptions) of £3 3*s.* each map. The price of the whole series, for proof impressions, being 125 guineas. Their surveys commenced in 1817 and were continued till 1834. In May, 1824 (as appears from an original prospectus and advertisement in my collection), 15* of these maps had been issued. Work had then been proceeding "with unremitted application during a period of nearly Ten Years," and they expected to complete the survey "within the further period of about Six Years." Other maps appeared subsequently, and the whole of this set (with the exception of the maps of Bucks, Cambs, Hereford, Herts, Norfolk, and Oxfordshire, which were never published), making up, with S.E. Wales and a very fine map of London on a scale of 8 inches to the mile, a series of 34 maps, was completed about 1830. The Greenwoods commenced in 1829 the publication of the series of smaller maps afterwards collected in the above-mentioned atlas. In that year 11 maps appeared (July 4th), in 1830 12 were issued, and, in 1831, 11. There was then a break, and 12 more (including Herts) were published in 1834 (April 1st), which is the date of the title-page of the atlas itself.

The two series of maps contain the same details and ornamentations, and are drawn and coloured in a similar style. They constitute by far the most artistic, complete, and interesting set of county maps ever issued. The details are very complete and clear, the engraving and colouring are very good, and the marginal views are in nearly every case charming pictures.

* Yorkshire, Lancashire, Cheshire, Middlesex, Durham, Staffordshire, Wiltshire, Kent, Warwickshire, Worcestershire, Somersetshire, Cumberland, Surrey, Westmoreland, and Berkshire.

1834. Rodwell, Mary Martha. $3\frac{5}{8} \times 3\frac{1}{8}$. Scale, about 12 miles = 1 inch.

An outline map of Hertfordshire, in a narrow double-ruled border, forming the lower half of a small octavo page, of which a map of Buckinghamshire fills the upper part. The two maps are separated by a thin, double line. They show the county boundaries, the rivers and their branches (their names represented by the letters *a*, *b*, *c*, etc.), and the principal towns (the latter numbered 1, 2, 3, etc.). These letters and numbers refer to lists at the head of the descriptions of the respective counties in the letterpress. The extent of the common boundaries of the five counties adjoining Hertfordshire is indicated by faint dotted lines drawn a little distance from the actual boundary. At the top of the map: "Hertfordshire," in small, open capitals.

From 'The Geography of the British Isles,' a work in dialogue, "illustrated with separate blank maps and explanatory keys; showing the relative situations, boundaries, principal towns, rivers, etc. of each county. For the use of young persons and schools. By Mary Martha Rodwell." 2 vols. London, 1834, small 8vo. Vol. i of this publication contains 54 maps of the English and Welsh counties, with one of Wales and one of the Isle of Man, printed two maps on a page. Vol. ii contains Scotland and Ireland.

*** 1834 (c). Pigot, James, & Co.** $14 \times 8\frac{5}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Pigot & Son.

A map of the county from the plate believed to have been previously used successively in or about 1826, 1829, and 1832, in Pigot & Co.'s 'Directory' (*ante*, pp. 192, 193, 197, 198), showing the usual details, with the parks shaded (no railways). The latitude and longitude are marked in the usual way in the border. In the top border, in the centre, in a panel slightly wider than the border itself: "Hertfordshire," and, in the centre of the bottom border, in a similar panel, a scale of miles. Below the title, in the centre of the upper part of the map, a star-indicator of the north. In the left-hand top corner a view of St. Albans Abbey, with a spire and flagstaff, taken from the south-south-east, and title below: "S^{t} Albans Abbey Church." In the right-hand top corner a long "Explanation," and, below, a "Reference to the Hundreds," with a list in two columns. Below the map, in the centre: "Published by Pigot & Co. 1 Basing Lane London, and Fountain St. Manchester," and, on the right: "Engraved on Steel by Pigot & Son Manchester."

From 'Pigot & Co's National London, and Provincial Commercial Directory, For 1834,' described as the "Fifth Edition Improved." London and Manchester, no date, large 8vo.

1835. Walker, John and Charles. $15\frac{1}{2} \times 12\frac{1}{2}$. Scale, 1 mile = $\frac{3}{8}$ inch.

A map of Hertfordshire, issued as one of a series of the county maps of England in 1835 and the following years, folding for the pocket in 12mo. It shows all the usual details after the Ordnance

Survey maps, with the parks, hills shaded, and distances of towns from London and between towns indicated on the principal roads, as well as the directions they take after leaving the county boundary. The line of the Birmingham Railway is also inserted. The border is double-ruled, with the degrees and minutes of latitude and longitude marked in it. In the left-hand top corner, in a long panel: "Hertfordshire," in ornamental capitals, and, below: "By J. & C. Walker." Below again, a scale of six "English Miles," and furlongs. Below this scale are particulars of the area, population (1831), and representation in Parliament of the county, and a list of the hundreds, and of the boroughs (Hertford and St. Albans) returning members to Parliament. In the right-hand top corner is a rather large and finely-engraved star-indicator of the points of the compass, and, in the bottom corner on the same side of the map, the place of election and a list of the polling places, with, below, an indication of the boundaries of the boroughs (which latter are shown on the map by a thin blue line). At the foot: "Published by Longman, Orme, Rees & Co. Paternoster Row London June 1st 1835."

This appears to be the first issue of this set of county maps. They were collected into an atlas in 1841, and published under the title: 'British Atlas.' It contained 47 maps.

I have also seen a map of Herts, reprinted from the same plate as the above, dated 1846. Hobson's 'Fox Hunting Atlas,' issued about 1848, contains the same set of maps, and the 'British Atlas' was re-issued in 1862 and 1870. Subsequently the maps were reprinted from time to time by Edward Stanford, both plain and as fox-hunting maps, folding for the pocket, 1872 (c), 1885 (c), 1892 (c). There were probably other issues at intermediate dates between 1835 and 1900.

1835. Lewis, Samuel. $9\frac{1}{8} \times 7\frac{3}{8}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Drawn by R. Creighton.

An outline map of the county in a slightly ornamented border, giving the divisions of the hundreds, the main roads, the towns and a few villages, the boroughs returning members to Parliament, and the county polling-places. In the left-hand top corner: "Hertfordshire," and a star-indicator of the points of the compass. In the bottom corner on the same side of the map, a scale of 7 miles, and, in the right-hand bottom corner, a table of "Explanations", with signs corresponding with those on the map. Below the border, at the left-hand corner: "Drawn by R. Creighton," and, at the right-hand corner: "Engraved by J & C. Walker." At the right-hand side of the map, outside the border close to the bottom corner, is the number of the plate: "XXXV."

From a supplementary volume issued with the third edition (1835) of the 'Topographical Dictionary,' of which it forms a fifth volume, entitled: 'View of the Representative History of England, with Engraved Plans, shewing the Electoral Divisions of the several Counties, and the former and present boundaries of the cities and boroughs.' By Samuel Lewis. London, 1835, 4to. The

map of Herts is followed by a plate (No. 36) containing plans of Hertford and St. Albans. There are 116 plates of the English counties and Parliamentary boroughs in this work.

(It was reprinted in 1840.)

*** 1835. Lewis, Samuel.** 9 × 6⅞. Scale, about 5 miles = 1 inch. Drawn on steel by R. Creighton.

A reprint of the map of the county of 1833, unaltered from that state.

From 'A Topographical Dictionary of England.' By Samuel Lewis. Third edition. 4 vols. London, 1835, 4to.

1836. Moule, Thomas. 10¼ × 7¾. Scale, about 5 miles = 1 inch. Engraved by W. Schmollinger.

A map with an irregular and very ornamental border, with views, architectural designs, and coats of arms engraved in or within it.

The map itself shows the hundreds (indicated by numbers referring to a list in the margin), rivers, the Grand Junction Canal, the principal and some cross roads, the towns, villages, parks, and houses, with the hills in the north of the county shaded. The roads and some other details are in some parts carried beyond the county boundary, and indications of the directions of the roads are given. In the left-hand top corner is a view of St. Albans Abbey from the west, and, below it, a series of ornamental gothic arches, and, again below, two shields, the one on the left containing a hart lying down to right, the other, which has a black border ornamented with studs, showing a castle with three turrets and flags. To the right of the view of the Abbey, along the top margin of the map, a scroll with: "Hertfordshire," and below it the arms of St. Albans in a shield. In the left-hand bottom corner is a gothic archway with: "Reference to the Hundreds." In the right-hand top corner a shield with coronet. In the right-hand bottom corner a gothic arch, as on the left side of the map, but the lower part covered by a view of Cashiobury. Above this view another coat of arms with coronet, and, to the left, a crowned and robed figure holding a shield. Below margin of map: "Engraved for Moule's English Counties, by W. Schmollinger." No meridians or scale on the map.

From 'The English Counties Delineated; or, A Topographical Description of England,' by Thomas Moule, 2 vols., London, 1836, 4to. This appears to be the earliest edition of the complete work. It has a sub-title, engraved, and dated 1836: 'England's Topographer, or Moule's English Counties in the 19th Century.' In the Preface, "the commencement of its publication, in May 1830," is referred to, from which it may be supposed that the above map may have actually been issued much earlier than 1836. I have, however, not been able to fix any earlier date, if such earlier copies were issued. This work was reprinted in 1837 and 1838, and probably at later dates. At all events, later copies of the map of Herts are found; five states in all, distinguished by successive additions in the details of the map, etc., have come under my notice, but of these I have only been able to date two.

*** 1836. Bell, James.** $9\frac{3}{8} \times 7\frac{7}{16}$. Scale, about $4\frac{1}{2}$ miles = 1 inch. Engraved on steel by Gray & Son.

An unaltered reprint of the Hertfordshire map in the 'Comprehensive Gazetteer' of 1833–34.

From 'A New and Comprehensive Gazetteer of England and Wales.' By James Bell. 4 vols. Glasgow, 1836, 8vo. Apparently the second edition of this Gazetteer.

*** 1836. Hall, Sidney.** $9\frac{11}{16} \times 7\frac{9}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. [Engraved October, 1830.]

A further issue of the map of Herts described under the date 1832, but differing from that impression by the insertion of the "London and Birmingham Railway", the correction of the number in the imprint at foot from 168 to 186 (as in the atlas of 1833), and the omission of the date previously appearing in the imprint.

From 'A New British Atlas,' probably the second edition, London, 1836, 4to.

*** 1837. Moule, Thomas.** $10\frac{1}{4} \times 7\frac{3}{4}$. Scale, about 5 miles = 1 inch. Engraved by W. Schmollinger.

An unaltered copy of the map of Hertfordshire described under date 1836.

From another edition of 'The English Counties Delineated.' 2 vols. London, 1837, 4to.

*** 1838. Moule, Thomas.** $10\frac{1}{4} \times 7\frac{3}{4}$. Scale, about 5 miles = 1 inch. Engraved by W. Schmollinger [James Bingley].

A map of Herts reprinted from the plate previously used, but slightly altered as follows: the London and North-Western Railway inserted; between the two shields on the left-hand side of the map: "County returns 3 members"; the name "James Bingley" inserted at foot in place of that of Schmollinger.

From a copy of 'The English Counties Delineated.' 2 vols., London, 1838, 4to, in which an additional title dated 1838 is inserted.

(The other copies of the map of Herts which I have seen, but for which I cannot assign any exact date, are (1) without railways or the line of text between the shields, but with Bingley's name at foot, which seems to have been struck off the plate between the issues of 1837 and 1838; (2) with the Great Eastern Railway shown, and the imprint at foot replaced by the figure 5, issued later than the print of 1838; (3) again later, an example with railways, and railway stations shown, and at foot the imprint replaced by a scale of 10 miles, and the indication: "Railway Stations thus ●")

*** 1838. Pigot, James, & Co.** $14 \times 8\frac{15}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Pigot & Son.

A reprint of the map of 1826 (c) and subsequent dates, as described under date 1834 (c), with the addition of the "Birmingham and London Ry.", and the "Cambridge Ry", and in the "Explanation" below, in two lines, "Polling Places", and "Rail Roads", the

former indicated by a black triangular spot on the map. In the imprint, "59 Fleet Street" is substituted for "1 Basing Lane."

From 'Pigot & Co^s British Atlas, comprising the Counties of England, (upon which are laid down all railways complete and in progress).' . . . London, no date, fol. This collection has 40 county maps. The frontispiece map, of England and Wales, is dated at foot 1838, and the populations of 1821, and (as additional information) of 1831, are given. It seems probable, therefore, that there may have been an earlier issue of this atlas.

*** 1839 (c). Pigot, James, & Co.** $14 \times 8\frac{15}{16}$. Scale, $4\frac{1}{2}$ miles = 1 inch. Engraved by Pigot & Son.

A reprint of the Hertfordshire map of 1838, unaltered, as found in 'Pigot & Co's British Atlas.'

From 'Pigot & Co's Royal National, Commercial, and Street Directory of London, For 1840, . . . To which are added Directories of the Counties of Bedford, Cambridge, Essex, Herts, . . .' London, no date, large 8vo.

1840. Duncan, James. $17\frac{1}{16} \times 13\frac{3}{4}$. Scale, $2\frac{3}{4}$ miles = 1 inch. Engraved by Hoare & Reeves.

A clearly-engraved map of the county in a ruled border, showing the hundreds, the rivers, main and cross roads, canals, towns, villages and hamlets, with the parks and woods, and a few hills. The miles between towns are marked on the main roads, and indications are given of direction and distance where they leave the county. In the left-hand top corner the title is as follows:—"New Map of the County of Hertfordshire; Divided into Hundreds Containing the District Divisions and other Local Arrangements effected by the Reform Bill." Below the title, a star-indicator of the points of the compass with long ornamental javelin-head, and to its left a "Reference to the Hundreds." In the left-hand bottom corner: "County Members 3. Elections at □". In the right-hand bottom corner a long "Explanation", and a "Scale" of 10 miles. Below the map, in the centre: "London Published by J. Duncan, Paternoster Row." On the right, below the map: "Hoare & Reeves *sc.* 90, Hatton Gard^n."

From 'A Complete County Atlas of England and Wales, containing Forty-four superior Maps, with all the Railroads and Improvements, projected or completed. Divided into Hundreds, with the District Divisions, and other Local Arrangements effected by the Reform Bill.' London, no date, fol. On the cover of a copy in my collection is stamped: "Rail Road County Atlas 44 Maps 1840," but in this copy, although some of the maps show the railways, the map of Herts has none, though the map of England and Wales, which is the first in the series, shows the London and Birmingham and the London and Cambridge lines passing through the county.

(Another impression of this map exists with the railways from Birmingham to London and from London to Cambridge inserted, but I cannot give it any exact date.)

*** 1840. Lewis, Samuel.** 9 × 6⅞. Scale, about 5 miles = 1 inch. Drawn on steel by R. Creighton.

A further reprint of the Hertfordshire map of 1831, as altered in 1833, but with slight further amendments.

From 'A Topographical Dictionary of England.' By Samuel Lewis. Fourth edition, in 4 vols. London, 1840, 4to.

*** 1840. Lewis, Samuel.** 9⅛ × 7⅜. Scale, 4½ miles = 1 inch. Drawn by R. Creighton.

A reprint, unaltered, of the Parliamentary map of 1835.

From the 'View of the Representative History of England' by Samuel Lewis, issued as a supplemental volume with his 'Topographical Dictionary of England,' editions of 1835 and 1840. London, 1840, 4to.

*** 1840. Parliamentary Gazetteer of England and Wales.** 9⅜ × 7 3/16. Scale, about 4½ miles = 1 inch. Engraved on steel by Gray & Son.

A reprint of the map of the county in the 'New and Comprehensive Gazetteer' of 1833 and 1836, with the railway "From Birmingham" shown by a thin black line.

From 'The Parliamentary Gazetteer of England and Wales,' published by A. Fullarton & Co., in 12 vols. London, Edinburgh, and Glasgow, 1840, 8vo.

1840 (c). Dugdale, Thomas. 9⅜ × 7¼. Scale, 5 miles = 1 inch. Engraved by J. Archer.

A clearly-drawn map showing the usual details, with hill-shading along the Chalk Downs in the north of the county, and the "London and Birmingham", and "Northern and Eastern" railways, with the Hertford branch of the latter. It has a plain, double-ruled border, showing the degrees and minutes of latitude and longitude, with, outside, at the top right-hand corner, a small number 18, and, below the map, in the centre: "Engraved for Dugdale's England and Wales Delineated", and, on the right: "Drawn and Engraved by J. Archer, Pentonville, London." In the left-hand top corner: "Herttordshire", and, below, a scale of miles. In the right-hand top corner, numbered to correspond with numbers on the map, a list of the hundreds in a single column, and, in the bottom corner on the same side of the map, an "Explanation". In the bottom border: "Meridian of Greenwich".

This map forms one of a series of county maps by Archer found in successive issues of the 'Curiosities of Great Britain. England and Wales Delineated,' London, 8vo, which were published undated, and are consequently difficult to assign to any year, even approximately. I have not seen a copy actually containing the particular state of the set of maps of the above date. But, as the railways shown on the map were opened respectively in 1838 and 1840, the latter date seems a probable one. A copy in my library referred to under date 1843, has Roper's maps.

At least three other states of this map exist, two of them being described under the dates 1850 and 1860. There seems to have

been a much earlier issue, without railways, of which maps of a few counties occur in a copy in my possession of the 'English Topography' of 1816 (*ante*, p. 185).

1840 (c). Pocket Topography and Gazetteer of England. $6\frac{3}{8} \times 4\frac{1}{4}$. Scale, 10 miles = 1 inch. Engraved by Pigot & Slater.

A map of Herts in a ruled border, showing the degrees and minutes of latitude and longitude. It gives the county boundaries, the main and some cross roads, the rivers and canals, the Birmingham and London, and Cambridge railways, with towns, villages, and parks. The details are carried to the margin of the map, so as to include parts of Beds, Bucks, Essex, and Middlesex. In a panel in the centre of the top border, slightly projecting above and below it: "Hertfordshire.", in ornamental letters. In a similar panel in the bottom margin a "Scale of Miles" (10). In the right-hand top corner a slightly-drawn arrow-head indicator of the north, and, in the left-hand top corner, an "Explanation", giving the turnpike roads, railroads, rivers, canals, and boundary of counties. At the foot of the map, below the centre: "Published by Pigot & C° London and Manchester"; and on the right: "Pigot & Slater Engravers Manch^{r}".

From 'A Pocket Topography and Gazetteer of England,' published by Pigot & Co., in 2 volumes. London, no date, 12mo. The above date is somewhat problematic. Vol. i appears from its Preface to have been issued "some time in advance of the second" In vol. i the census of 1831 is quoted, in vol. ii that of 1841. At the same time the insertion of the Birmingham Railway (opened in 1838), and that to Cambridge, point to a late period in the census decade. The whole work is dated 1842 (?) in the British Museum Library Catalogue.

***1840 (c). Teesdale, Henry, & Co.** $16\frac{5}{16} \times 13\frac{5}{16}$. Scale, about 3 miles = 1 inch.

A reprint of the map of 1829 (c), with the addition of a road shortening, and in substitution for the old main road between Chipping Barnet and South Mimms, drawn-in and coloured, and described as the "New Road."

From a copy of the 'New British Atlas.' London, no date, 4to. A copy in my collection, with the line on the title-page as to revision and correction redated "1840." There are water-marks on the paper of various maps, 1829, 1830, 1831, and 1835. On the binding of this atlas is the date 1845.

Upon another copy of the map in this state, in the collection of Mr. Greg, is drawn across the original details, as if inserted after the plate was first engraved, a branch of the Grand Junction Canal from Rickmansworth, passing through Watford and Little Munden to St. Albans, and marked: "St. Albans Branch." I am unable to assign a satisfactory date to this impression, but it must have been later than the one above noted, upon which no trace of this projected canal exists.

*** 1840 (?). Dix, Thomas.** $17\frac{7}{16} \times 14$. Scale, about 3 miles = 1 inch.

A reprint of Dix's map of Herts of 1816 exists in the British Museum, and is dated in the Catalogue as above; it differs from the earlier impression as follows:—the title is engraved on the right of the view of Waltham Cross: "Hertford, divided into Hundreds and the Parliamentary Divisions"; a "Reference to the Hundreds", in one column, is engraved in the right-hand top corner, Braughing being spelt with a terminal *g*, and Edwins Tree in two words; the "Explanation" is transferred to the right-hand bottom corner, and replaces the original title, which has been erased; along the bottom of the map, on the left of the scale of miles, is added: "The County of Hertfordshire returns three Members to Parliament", and the imprint at foot is: "London: William Darton & Son; 58 Holborn Hill." There is also a copy of this issue of Dix's map in the Lewis Evans collection.

As no railways are shown, the map must have been printed earlier than the date given above. The reference to the members of Parliament would place it after 1832, and the absence of railways before 1838, the date of the opening of the London and Birmingham line. The British Museum copy folds in a cover, with, inside: "Darton & Son's Maps of the English Counties, Just Published, size, 18 Inches by 15", and there follows a list of 43 maps of the counties, including larger ones of Yorkshire, and North and South Wales.

Mr. Andrews has an impression of this edition of the map which wants the imprint.

(There is also a still later state which may be ascribed to about 1852.)

*** 1841. Walker, John & Charles.** $15\frac{1}{2} \times 12\frac{1}{2}$. Scale, 1 mile = $\frac{3}{8}$ inch.

A reprint of the map of Herts of 1835, in a collection bearing the title 'British Atlas,' which contains 47 maps, with railroads inserted up to date. I have not been able to examine a copy of this atlas, but it is, presumably, the first issue of the atlas described under date 1862. London, fol.

*** 1842. Leigh, Samuel.** $2\frac{7}{8} \times 4\frac{3}{4}$. Scale, 10 miles = $\frac{7}{8}$ inch. Engraved by Sidney Hall.

A reprint of the map of Herts described under date 1820, altered by the insertion of the Birmingham and Cambridge railways, the omission of the imprint at the right-hand bottom corner of the page, and the alteration of that on the left-hand side to: "Pub. by M. A. Leigh 421 Strand."

From 'Leigh's New Pocket Atlas of England and Wales.' London, 1842, 12mo. It contains fifty-five maps of the counties, and a general map, with an Introduction dealing with the origins of the names and divisions of England and Wales, but has no Index. It is published by "G. Biggs, Successor to Leigh & Son, 421, Strand, (Removed from No. 18)".

XXVII.

METEOROLOGICAL OBSERVATIONS TAKEN IN HERTFORDSHIRE IN THE YEAR 1904.

By John Hopkinson, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C. E.

Read at Watford, 29th March, 1905.

Meteorological observations continue to be taken in Hertfordshire at the same stations as they have been for some years. The hour of observation is 9 a.m. All the records relate to the day of observation except those of the maximum temperature and the rainfall, which are entered to the previous day. Shade temperatures only are given; those for Bennington, Berkhamsted, and St. Albans being from thermometers in Stevenson screens, and those for New Barnet from thermometers under a Glaisher stand.

Information as to the stations has been given in my paper on "The Climate of Hertfordshire" in the previous volume of our 'Transactions' (pp. 125–126). The averages with which the results are compared are those for the twelve years 1887–1898 as there given, except for the rainfall, which is compared with the average for the sixty years 1840–1899 (p. 132 of same paper).

Table I.—*Results of Climatological Observations taken in Hertfordshire in the Year* 1904.

Stations	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Bennington	48·4	41·2	55·5	14·3	19·8	86·6	82	7·4	21·85	213
Berkhamsted	48·3	40·6	56·1	15·5	17·5	85·9	83	7·2	24·48	175
St. Albans	48·5	41·3	55·6	14·3	20·3	86·8	82	7·2	25·42	182
New Barnet	49·6	41·1	58·1	17·0	19·7	91·0	82	6·7	22·48	167
County.....	48·7	41·0	56·3	15·3	17·5	91·0	82	7·1	23·56	184

The year 1904 was rather warm, the mean temperature being 0°·4 above the average. The mean daily range was small, being 0°·6 less than the average, owing entirely to the warmth of the nights. The air, at 9 a.m., was of average humidity. The sky, at the same hour, was rather more cloudy than usual, there was about the usual number of sunless days, and the sun shone brightly for about its average duration. The rainfall was rather small, being about two and a half inches below the average, but there were more wet days than usual.

Compared with the average, January and October were warm months, and April and July were very warm; March, June, and September were cold; November was rather cold, and December rather warm. The air was drier than usual in April and June, and much drier than usual in July and August; it was unusually humid in January and March. The sky was much brighter than usual in July and August; it was cloudy from January to March and in October, and most unusually so in May and December. January, May, and July were wet months, and February was very wet; September, October, and November were dry, and April and June were very dry. Rain fell on many days in January and December, and more often than usual in February, March, and May; it fell on very few days in June, and less frequently than usual in April, July, and August.

TABLE II.—*Means of Climatological Observations (with Extremes of Temperature) for the Seasons of* 1903–1904.

Seasons	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Winter	37·6	32·8	42·4	9·6	20·0	55·3	91	7·9	8·37	57
Spring	47·1	39·3	54·9	15·6	22·9	74·0	80	7·4	4·56	45
Summer	60 8	50·5	71·1	20·6	38·8	91·0	70	5·8	6·25	32
Autumn	48·7	41·3	56·2	15·0	17·5	74·9	87	7·0	4·39	44

The Winter of 1903–4 (Dec. to Feb.) was rather mild, owing to the warmth of the nights, the days having been rather colder than usual; the mean daily range of temperature was therefore small. The air was humid and the sky cloudy at 9 a.m. The rainfall was very heavy, exceeding the average by nearly 70 per cent., and there were many wet days. The duration of sunshine was twenty minutes a day less than usual. South-westerly winds mostly prevailed.

The Spring (March to May) was also rather warm, again owing to the warmth of the nights, the days having been colder than usual, making the mean daily range of temperature very small for the season. The air was rather humid and the sky very cloudy. The rainfall was rather small, but the number of wet days was large, and there was no prolonged dry period. The duration of sunshine was nearly an hour a day less than usual. Westerly winds greatly prevailed, to the almost total exclusion of easterly, except in March.

The Summer (June to August) also was rather warm, but, unlike the Winter and Spring, owing to the warmth of the days, the nights having been of average temperature; the mean daily range was therefore considerable. The air was very dry and the

sky was bright. The rainfall was rather less than usual, and the number of wet days was unusually small. The duration of sunshine was an hour and a half a day longer than usual, which is an exceptional deviation from the average. Westerly winds prevailed.

The Autumn (Sept. to Nov.) was cold, both days and nights having been colder than usual, giving an average mean daily range of temperature. The air was rather humid and the sky rather cloudy. The rainfall was very small, being about 60 per cent. below the average, but the number of wet days was about the same as usual. The duration of sunshine was nearly a quarter of an hour a day longer than usual. Westerly winds prevailed.

TABLE III.—*Means of Climatological Observations (with Extremes of Temperature) taken at Bennington, Berkhamsted, St. Albans, and New Barnet, during the Year* 1904.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	37·6	32·3	42·9	10·6	20·1	55·0	94	8·0	3·06	23
Feb.	38·2	33·2	43·1	9·9	24·6	55·3	87	7·4	3·18	19
March	39·9	33·1	46·7	13·6	22·9	59·8	87	7·7	1·45	17
April	48·5	40·1	56·9	16·8	27·7	66·6	75	6·6	·97	11
May	52·9	44·7	61·2	16·5	32·7	74·0	77	8·0	2·14	17
June	57·1	47·1	67·0	19·9	38·8	77·0	72	6·7	·92	9
July	64·7	53·9	75·5	21·6	48·1	88·6	68	5·4	3·12	11
August	60·6	50·5	70·7	20·2	40·2	91·0	71	5·4	2·21	12
Sept.	54·8	45·9	63·7	17·8	35·1	74·9	82	6·0	1·40	14
Oct.	49·9	42·6	57·3	14·7	25·7	69·9	88	7·6	1·35	15
Nov.	41·5	35·3	47·7	12·4	17·5	60·2	91	7·3	1·64	15
Dec.	38·6	33·7	43·4	9·7	19·7	56·6	91	8·9	2·12	21
Year	48·7	41·0	56·3	15·3	17·5	91·0	82	7·1	23·56	184

JANUARY.—Mild, humid, cloudy, and wet. Both days and nights were warmer than usual. The relative humidity was considerably above the average, the cloud slightly above, the rainfall nearly double, and the wet days nearly 50 per cent. in excess. There were only a few unseasonably cold days (20th to 25th). The minimum temperature was below 32° on 17 days at Berkhamsted and 15 at St. Albans. The duration of sunshine was a little short of the average. The prevailing direction of the wind was S.S.W.

FEBRUARY.—Rather mild, of average humidity, cloudy, and excessively wet, with many wet days. The mean temperature was half a degree above the average, although the days were rather colder than usual, the nights being unusually warm, and the daily range of temperature therefore very small. The first half of the month was much warmer than the second half, and the first three

TABLE IV.— *Climatological Observations taken at* BENNINGTON HOUSE, BENNINGTON. *Latitude:* 51° 53′ 45″ N. *Longitude:* 0° 5′ 20″ W. *Altitude:* 407 *feet. Observer:* REV. J. D. PARKER, LL.D., F.R.Met.Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	37·5	32·7	42·2	9·5	20·9	53·3	95	7·9	2·44	26
Feb.	37·6	33·0	42·3	9·3	24·9	52·9	86	7·8	2·82	20
March	39·4	32·9	45·8	12·9	22·9	57·7	87	7·6	1·24	20
April	48·1	40·1	56·1	16·0	34·8	64·2	74	7·3	·80	12
May	52·0	44·6	59·5	14·9	35·0	71·4	78	8·6	1·56	19
June	56·5	47·1	65·9	18·8	42·7	74·2	72	7·2	·80	10
July	64·5	53·9	75·1	21·2	53·9	85·1	66	5·7	3·67	12
August	60·7	51·3	70·1	18·8	42·8	86·6	70	6·0	2·51	12
Sept.	54·6	46·5	62·7	16·2	35·1	71·9	82	6·4	1·24	20
Oct.	49·8	43·0	56·5	13·5	34·0	68·1	87	7·9	1·20	18
Nov.	41·3	35·5	47·1	11·6	19·8	58·2	92	7·2	1·51	22
Dec.	38·3	33·5	43·1	9·6	20·3	54·5	92	9·5	2·06	22
Year	48·4	41·2	55·5	14·3	19·8	86·6	82	7·4	21·85	213

TABLE V.— *Other Meteorological Observations taken at Bennington by the Rev. Dr. Parker.*

Months	Pressure of the atmosphere	Temperature at 9 a.m.				Days of		Bright Sunshine		
		of the air	of evaporation	of the soil		clear sky	overcast	Total hours	Max. in one day	Sunless days
				at 1 ft.	at 2 ft.					
	ins.	°	°	°	°					
Jan.	29·990	37·0	36·4	37·9	38·9	3	18	47	6·6	16
Feb.	·624	37·3	35·7	38·7	39·5	0	12	69	7·2	3
March	30·021	39·1	37·5	39·8	40·2	2	14	108	9·6	8
April	29·973	48·7	44·9	46·9	46·6	3	12	176	12·0	1
May	·986	52·3	49·1	52·8	52·1	1	16	155	15·0	4
June	30·085	57·3	52·6	58·7	58·0	3	13	211	14·6	1
July	·059	65·5	59·0	65·6	64·9	7	8	251	15·2	1
August	·049	61·8	56·4	63·1	63·3	4	7	226	13·4	1
Sept.	·104	55·2	52·4	57·2	58·4	5	11	174	11·8	1
Oct.	·137	50·1	48·3	51·8	53·0	3	15	113	9·0	6
Nov.	·098	39·5	38·5	44·7	46·7	3	15	73	8·1	8
Dec.	29·977	37·8	36 9	40·2	41·5	0	20	52	5·4	13
Year	30·009	48·5	45·6	49·8	50·3	34	161	1655	15·2	63

TABLE VI. — *Climatological Observations taken at* ROSEBANK, BERKHAMSTED. *Latitude :* 51° 45′ 40″ N. *Longitude :* 0° 33′ 30″ W. *Altitude :* 400 *feet. Observer :* EDWARD MAWLEY, F.R.Met. Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	37·9	32·6	43·2	10·6	21·6	54·2	95	8·0	3·37	22
Feb.	38·0	33·0	43·0	10·0	24·6	53·0	88	7·3	3·50	18
March	39·7	32·9	46·4	13·5	24·9	58·7	88	8·4	1·38	17
April	48·4	39·9	57·0	17·1	32·1	65·4	75	6·7	1·17	12
May	52·2	44·0	60·4	16·4	34·3	68·6	77	7·6	2·27	16
June	56·5	46·5	66·4	19·9	39·4	77·0	73	6·7	1·13	9
July	64·0	53·4	74·6	21·2	48·1	85·1	69	5·5	3·02	11
August	60·2	50·2	70·2	20·0	40·9	85·9	72	5·2	2·18	12
Sept.	54·3	44·9	63·8	18·9	35·7	71·8	82	6·0	1·33	11
Oct.	49·6	41·8	57·3	15·5	30·0	69·6	90	8·0	1·20	13
Nov.	41·1	34·6	47·7	13·1	17·5	58·5	92	7·9	1·66	14
Dec.	38·1	32·9	43·3	10·4	20·6	55·0	93	8·7	2·27	20
Year	48·3	40·6	56·1	15·5	17·5	85·9	83	7·2	24·48	175

TABLE VII. — *Other Meteorological Observations taken at Berkhamsted by Mr. Mawley.*

Months	Pressure of the atmosphere	Temperature at 9 a.m.				Days of		Bright Sunshine		
		of the air	of evaporation	of the soil		clear sky	overcast	Total hours	Max. in one day	Sunless days
				at 1 ft.	at 2 ft.					
	ins.	°	°	°	°					
Jan.	29·963	37·0	36·5	36·8	38·8	4	17	37	5·8	19
Feb.	·601	36·9	35·5	37·9	39·5	1	12	49	6·0	8
March	·997	38·3	36·9	39·8	40·8	2	17	85	8·1	9
April	·956	48·7	45·0	48·4	47·9	4	10	164	12·1	2
May	·966	52·8	49·2	53·8	52·9	2	11	136	13·3	5
June	30·071	57·0	52·5	59·9	59·0	3	13	196	13·1	1
July	·050	65·0	59·3	66·0	64·5	7	7	246	13·8	2
August	·041	61·6	56·7	63·3	63·8	5	5	229	13·0	1
Sept.	·091	55·1	52·4	57·6	59·2	8	8	166	11·3	3
Oct.	·129	49·2	47·9	51·8	53·6	3	14	93	8·8	9
Nov.	·085	39·2	38·2	44·4	47·5	1	14	57	7·3	9
Dec.	29·954	37·8	37·0	39·0	41·2	0	18	32	4·9	16
Year	29·992	48·2	45·6	49·9	50·7	40	146	1490	13·8	84

weeks only were wet, no appreciable amount of rain falling during the last week. The duration of sunshine was below the average. The prevailing direction of the wind was S.W., closely followed by E. and W.

March.—Cold, humid, and cloudy, but with very little rain, except for a few days at the beginning and end of the month. The days only were unseasonably cold, the nights being very little colder than usual. This was especially the case during the first week. Snow which fell on the 3rd covered the ground to the depth of about an inch, being deeper than at any time in the Winter. The duration of sunshine was considerably below the average. The prevailing direction of the wind was N.E., closely followed by N. and E.

April.—Very warm, with a dry atmosphere, an average amount of cloud, and a very small rainfall. The high temperature was due much more to the warmth of the nights than to that of the days, the mean daily range being small. About one-third of the rain fell on the 22nd, which was almost the only wet day in the second half of the month. There was a little more sunshine than usual. Westerly winds very greatly prevailed, and there was a remarkable absence of easterly winds.

May.—Of average temperature, rather humid, and very cloudy and wet. The nights were very warm and the days rather cold, the mean daily range of temperature being unusually small. Only a few days (6th to 10th) were cold. There were eight days in succession (12th to 19th) without any rain. There was an unusual absence of sunshine, the duration being two hours a day less than the average. The wind was due west for about two-thirds of the month and scarcely ever at all northerly.

June.—Cold, with a dry atmosphere, an average amount of cloud, and a very small rainfall. The days were about twice as much colder than usual than were the nights. No rain fell for the seven days 2nd to 8th, nor for the eight days 16th to 23rd. There was a little more sunshine than usual. The wind was mostly W. or S.W., seldom E. or N.E. At Berkhamsted on the 2nd, Mr. Mawley states, shortly after 3 p.m. during a sharp thunder-shower, rain fell for three minutes at the rate of $3\frac{1}{4}$ ins. an hour.

July.—Very warm, with a very dry atmosphere, a very bright sky, and a heavy rainfall, but few wet days. The high temperature was due nearly twice as much to the warmth of the days as to that of the nights, the mean daily range therefore being great. The seventeen days 8th to 24th were the hottest. The maximum temperature exceeded 75° on each of these days but the 20th, and it exceeded 80° on the 9th, 10th, 15th, and 17th. Nearly all the rain fell after the 24th during a succession of thunderstorms. On the 30th at Berkhamsted, in the first and most severe of two thunderstorms, rain fell in the nine minutes ending 1.30 p.m. at the rate of nearly $1\frac{3}{4}$ in. an hour. The duration of sunshine was nearly two hours a day more than the average. The wind was mostly from S. to W.

TABLE VIII.—*Climatological Observations taken at the* HERTFORDSHIRE COUNTY MUSEUM, ST. ALBANS. *Latitude:* 51° 45′ 15″ N. *Longitude:* 0° 19′ 56″ W. *Altitude:* 389 *feet. Observer:* JOHN HOPKINSON, V.P.R. Met. Soc.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	37·4	32·1	42·8	10·7	21·7	53·2	94	8·0	3·18	23
Feb.	38·0	33·3	42·8	9·5	25·3	51·6	86	7·4	3·36	19
March	39·5	33·2	45·7	12·5	25·6	57·4	86	7·7	1·50	16
April	48·0	40·5	55·4	14·9	35·2	63·0	75	6·9	1·06	12
May	53·4	45·4	61·5	16·1	35·0	71·2	76	8·0	2·66	18
June	56·4	47·1	65·7	18·6	41·9	75·0	72	6·6	1·00	9
July	64·2	54·1	74·2	20·1	48·6	84·6	67	5·3	3·60	11
August	60·3	51·2	69·5	18·3	42·9	86·8	70	5·6	2·08	12
Sept.	54·9	46·9	62·8	15·9	36·8	72·2	82	6·0	1·59	12
Oct.	49·8	43·1	56·5	13·4	34·3	63·4	88	7·6	1·45	14
Nov.	41·4	35·4	47·4	12·0	20·4	58·1	91	7·2	1·62	14
Dec.	38·6	33·7	43·5	9·8	21·4	54·1	92	9·0	2·32	22
Year	48·5	41·3	55·6	14·3	20·3	86·8	82	7·2	25·42	182

TABLE IX. — *Climatological Observations taken at the* GAS WORKS, NEW BARNET. *Latitude:* 51° 39′ 5″ N. *Longitude:* 0° 10′ 15″ W. *Altitude:* 212 *feet. Observer:* T. H. MARTIN, Assoc. M. Inst. C. E.

Months	Temperature of the Air						Humidity	Cloud, 0–10	Rain	
	Means				Extremes				Amount	Days
	Mean	Min.	Max.	Range	Min.	Max.				
	°	°	°	°	°	°	%		ins.	
Jan.	37·7	31·8	43·6	11·8	20·1	55·0	90	8·0	3·26	21
Feb.	39·1	33·6	44·5	10·9	25·7	55·3	87	6·9	3·04	19
March	41·0	33·3	48·7	15·4	23·7	59·8	86	7·1	1·67	16
April	49·7	40·0	59·3	19·3	27·7	66·6	75	6·4	·84	10
May	54·1	44·7	63·5	18·8	32·2	74·0	77	7·9	2·06	15
June	58·8	47·6	69·9	22·3	38·8	76·6	72	6·3	·75	8
July	66·3	54·4	78·2	23·8	49·7	88·6	69	5·1	2·18	9
August	61·3	49·4	73·2	23·8	40·2	91·0	71	4·6	2·07	12
Sept.	55·4	45·2	65·5	20·3	35·6	74·9	82	5·4	1·45	12
Oct.	50·6	42·3	58·8	16·5	25·7	68·8	87	7·0	1·56	14
Nov.	42·3	35·8	48·7	12·9	21·2	60·2	89	6·8	1·76	12
Dec.	39·4	34·9	43·8	8·9	19·7	56·6	88	8·5	1·84	19
Year	49·6	41·1	58·1	17·0	19·7	91·0	82	6·7	22·48	167

August.—Of average temperature, with a very dry atmosphere, a very bright sky, and a little less than the average rainfall. Nearly half the rain in the month fell on the 30th during a thunderstorm. The maximum temperature exceeded 85° on the 3rd and 4th, but on no other day did it reach 80°. The sun shone on the average for about an hour and a quarter a day longer than usual. Westerly winds largely prevailed.

September.—A cold month, of average humidity and cloudiness, and with a small rainfall. Days and nights were about equally below the average temperature. No appreciable amount of rain fell for the eight days 15th to 22nd. The sun shone on the average for nearly forty minutes a day longer than usual. The direction of the wind was mostly from E. to S.

October.—A warm month, of average humidity, cloudy, and with a very small rainfall. Days and nights were about equally above the average temperature. The rainfall was less than half the average. No appreciable amount fell for the nine days 7th to 15th. The duration of sunshine was a little below the average. Westerly winds greatly prevailed.

November.—Rather cold, of about average humidity and cloudiness, and with a small rainfall. The nights were just twice as much colder than usual than were the days. The low mean temperature was due to the coldness of the week ending 28th, on the coldest day of which the maximum temperature only just about reached freezing-point (a little below at Berkhamsted and a little above at St. Albans). Snow fell on 23rd, and covered the ground to the depth of nearly an inch and a half. The duration of sunshine was a little above the average. The wind was almost invariably from the west.

December.—Rather warm, of about average humidity, exceedingly cloudy, and with less than the average rainfall on an unusually large number of days. The slight excess of temperature over the average was due to the warmth of the nights. The only cold period in the month extended over the nine days 19th to 27th, and for most of this time thick fogs prevailed. There was about an average duration of sunshine. S.W. and W. winds prevailed. Mr. Mawley has called attention to the excessive calmness of the air during the greater part of the above-mentioned cold period, there being an absolute calm for the whole of one day for the first time during his Berkhamsted record of nineteen years; this calm period being followed on the 30th by the strongest wind experienced there for the last four years, the mean velocity for eight hours ending noon being 25 miles an hour.

XXVIII.

REPORT ON THE RAINFALL IN HERTFORDSHIRE IN THE YEAR 1904.

By John Hopkinson, F.L.S., F.G.S., V.P.R.Met.Soc., Assoc. Inst. C.E.

Read at Watford, 29th March, 1905.

The alterations in our rainfall stations for the year 1904 result in a gain of two on the number for the previous year, the losses being two and the gains four. Frogmore, St. Albans, disappears for a time, owing to the temporary removal of the observer, and the record at Frogmore, Watford, has ceased, owing to the observer's permanent removal in the Autumn. The gains are Hill End, St. Albans; Hillside, Buntingford; Holwell House, Hatfield; and Summerhill, Barnet. By these alterations the districts of the Ver and Lower Colne each lose one station, and those of the Upper Colne, Rib, and Upper and Lower Lea each gain one.

The principal table now contains the records of 54 stations, being two more than in any previous year. The number of daily records received is 50, or five more than for any previous year. Last year therefore takes the place of 1904 as a "record" one in number of returns and fulness of detail supplied.

The usual particulars of the rainfall stations, and of the rainfall, in 1904, are given in Tables I and II, pp. 219–221.

A supplementary table (Table III, p. 218) gives twelve other records of the total rainfall in the year. Five of these are from 'British Rainfall, 1904'; Frogmore, Watford, appears, as the gauge was left there until the end of the year when the rainfall was measured; and the other records are those of additional gauges at stations in the principal table.

The mean rainfall in Hertfordshire in the year 1904 was 23·27 inches. This is 1·51 inch below the average for the decade 1890–99, and 2·88 inches below that for the 60 years 1840–99. The mean number of wet days in the year was 167, which is the average number for the thirty years 1870–99, and 21 less than that for the previous year. Last year was therefore one of rather small rainfall of average frequency.

Droughts in 1904.—Although in the previous very wet year there was one very long "absolute" drought recorded at all stations, in 1904, when the rainfall was below the average, it is doubtful whether there was really an absolute drought at all, the small number of stations recording one (9) leading to the inference that the absence of a record was due to a slight fall or two, recorded at neighbouring stations, being overlooked. Such a drought is recorded to have lasted for 15 days, July 4 to 18, at four stations; for 20 days, July 5 to 24, at one station; for 21 days, July 4 to 24, at three stations; and for 24 days, July 1 to 24, at one station. There was no "partial" drought.

Table III.—Supplementary to Tables I and II.

District.	Station.	Observer.	Gauge. Diameter.	Gauge. Height above Sea.	Rainfall.	Days.
			ins.	feet.	ins.	
1.	Royston—Workhouse	H. Warren	5	217	19·67	156
,,	Odsey (2nd gauge)	H. G. Fordham	5	256 ⊼	18·08	167
4.	Tring—Elm House	E. J. Le Quesne	5	460	25·65	153
	Berkhamsted—					
6.	,, Rosebank (M)	E. Mawley	8	401 ⊼	24·07	
,,	,, Rose Cottage (M)	W. E. Milner	5	334 ⊼	24·54	
8.	Harpenden—Rothamsted	A. D. Hall	8	420 ⊤	23·22	161
,,	,, ,,	,,	7·2 × 8·7	420 ⊤	24·93	177
10.	Watford—Weetwood (M)	J. Hopkinson	5	269 ⊼	25·28	
,,	,, St. Albans Road	H. Ruddle	5	250	21·66	
,,	,, Frogmore	A. P. Blathwayt	5	189 ⊤	24·20	
17.	Croxley Green	S. I. Oddie	5	250 ⊤	24·73	141
,,	Stanstead Abbots	E. H. Barlow	5	115 ⊤	20·98	

M = gauge read monthly, in each case a second gauge.

Distribution of the Rainfall throughout the Year.—Of the total rainfall of 23·27 inches, 12·39 fell during the six winter months and 10·88 during the six summer months. During the first quarter of the year 7·39 ins. fell, during the second 6·96 ins., during the third 5·00 ins., and during the fourth 8·03 ins. During the Winter of 1903–4 (Dec. to Feb.) 8·02 ins. fell, during the Spring (March to May) 4·39 ins., during the Summer (June to August) 6·53 ins., and during the Autumn (Sept. to Nov.) 4·27 ins. In relation to the average, April, June, September, October, and November were dry months; February was very wet; and January and July were rather wet.

The difference in each month from the mean for the 60 years 1840–99 was as follows:—Jan., + 0·65 in.; Feb., + 1·45; March, — 0·23; April, — 0·71; May, — 0·07; June, — 1·10; July, + 0·72; August, — 0·06; Sept., — 0·97; Oct., — 1·66; Nov., — 0·97; Dec., + 0·07.

The absolute maximum falls in any one day in each month, and the stations recording them, were: Jan. 20, London Orphan Asylum, Watford, 0·73 in.; Feb. 2, Wigginton, 0·73 in.; March 28, Datchworth, 0·36 in.; April 22, Summerhill, Barnet, 0·40 in.; May 20, Pendley Manor, 0·73 in.; June 26, Broxbourne, 0·59 in.; July 25, The Chilterns, Hitchin, 2·71 ins.; Aug. 31, Wigginton, 1·39 in.; Sept. 30, Apsley Mills, 0·56 in.; Oct. 6, Northwood, 0·48 in.; Nov. 7, Gilston Park, 0·67 in.; Dec. 6, Wigginton, 0·76 in.

The day in each month on which a heavy fall of rain was most general over the county was: Jan. 30, Feb. 9, March 28, April 22, May 20, June 14, July 25, August 31, Sept. 30, Oct. 21, Nov. 7, Dec. 7; and in the year July 25 and August 31. July 25 was the wettest day in the year.

TABLE I.—HERTFORDSHIRE RAINFALL STATIONS, 1904.

District.	Station.	Observer or Authority.	Diameter of Gauge.	Height of Gauge above Ground.	Height of Gauge above Sea-level.	†
			ins.	ft. ins.	ft.	
1.	Royston—Melbourne Street	Joseph E. J. Phillips	8	0 11	201	T
,,	*Odsey	H. George Fordham	5	1 0	256	⅄
2.	*Baldock—High Street	F. W. Langston Day	5	1 0	214	⅄
3.	*Preston—The Laburnums	R. de V. Pryor	8	2 6	480	⅄
,,	Hitchin—Wratten	William Lucas	5	2 1	238	⅄
,,	,, The Maples	William Hill	8	1 1	220	T
,,	* ,, The Chilterns	Francis Ransom	5	0 9	300	⅄
,,	* ,, High Down	Joseph Pollard	5	1 1	422	⅄
4.	Tring—Pendley Manor	J. G. Williams	5	2 0	420	
,,	* ,, Bulbourne	Gordon C. Thomas	5	2 3	401	
6.	*Wigginton Vicarage	Rev. H. J. E. Burrell	5	1 0	700	⅄
,,	*Cowroast	Gordon C. Thomas	5	3 8	394	⅄
,,	*Berkhamsted—Fairhill	Miss M. Hopkins	5	1 0	548	⅄
,,	* ,, Rosebank	Edward Mawley	8	1 0	401	⅄
,,	* ,, Rose Cottage	W. E. Milner	5	1 0	334	⅄
7.	*Great Gaddesden Vicarage	Rev. W. T. T. Drake	8	1 0	427	⅄
,,	*H. Hempstead—Apsley Mills	J. Dickinson & Co.	24	0 9	260	
8.	*Kensworth—The Grove	Miss S. Grace Jones	5	1 5	630	B
,,	*Harpenden—Rothamsted	A. D. Hall	5	0 9	420	T
,,	*St. Albans—Gorhambury	W. Newberry	5	1 0	423	T
,,	* ,, Herts County Museum	John Hopkinson	5	1 0	389	T
,,	* ,, Bone Hill	H. J. T. Broadwood	5	1 0	336	⅄
9.	* ,, Hill End Asylum	G. Goodchild	5	1 0	295	T
,,	*Elstree—Aldenham House	Edwin Beckett	10 sqr.	4 9	305	
10.	*Watford—Weetwood	John Hopkinson	5	1 0	269	⅄
,,	* ,, Lond. Orph. Asylum	Dr. O. C. Cockrem	5	1 0	231	T
,,	*Colne Valley Water Works	W. Verini	5	1 2	220	
,,	*Rickmansworth—Moor Park	Lord Ebury	5	2 0	340	⅄
,,	*Eastbury—Valeney House	H. Langford Lewis	5	1 0	360	T
,,	*Northwood—Easby	Mrs. S. Fawcett	8	0 10	400	T
12.	*Welwyn—Danesbury	Col. A. M. Blake, C.B.	8	1 0	400	
,,	* ,, Bridge House	B. Wilfred Thomas	5	2 3	216	
,,	*Datchworth Rectory	Rev. Andrew Amos	5	1 0	372	⅄
13.	*Weston—Weston Park	M. R. Pryor	5	0 8	470	T
,,	*Bennington—Eileen Cottage	A. B. Legard	5	1 0	408	
,,	* ,, Bennington House	Rev. Dr. Parker	5	1 0	406	⅄
,,	*Knebworth—Manor House	Rev. S. R. Wigram	5	1 0	420	
14.	*Therfield Rectory	Rev. John G. Hale	5	4 3	510	⅄
,,	*Throcking Rectory	Rev. C. W. Harvey	5	1 0	487	⅄
,,	*Buntingford—Hillside	G. Melville Smith	5	1 0	350	T
,,	* ,, Hamels Park	E. Wallis	5	1 0	400	T
15.	*Much Hadham	T. Woodham Mott	5	1 0	222	B
16.	*Harlow—Gilston Park	Edward Leach	8	0 6	175	T
17.	*Hatfield—Holwell House	Wilfrid E. Laurie	5	1 6	175	T
,,	*Hertford—Bayfordbury	W. Clinton Baker	8	1 2	250	
,,	* ,, Sewage Works	W. B. Bryan	8	6 0	125	
,,	*Ware—Fanhams Hall	Miss V. M. Croft	8	1 0	235	T
,,	* ,, Red House	Joseph Francis	5	4 0	115	T
18.	*Hoddesdon—Feildes Weir	W. B. Bryan	8	3 8	95	
,,	*Broxbourne—Stafford House	G. J. Newbery	5	1 0	118	T
,,	*Northaw—St. Just	Miss E. S. Poland	5	1 0	392	
,,	*Hadley—Risegate	H. E. Freir	5	0 11	400	
,,	*Barnet—Summerhill	F. A. Milne	5	0 10	400	
,,	*New Barnet—Gas Works	T. H. Martin	8	0 9	215	

* Daily records received. † For explanation of these symbols see Vol. XI, p. 33.

TABLE II.—RAINFALL IN

River Districts.	Stations.	Jan.	Feb.	Mar.
		ins.	ins.	ins.
OUSE / CAM / 1. Rhee	Royston—Melbourne Street	1·89	2·66	1·38
	Odsey	1·85	2·52	1·39
2. Upper Ivel	Baldock—High Street	1·96	2·71	1·37
OUSE / IVEL / 3. Hiz	Preston—The Laburnums	2·51	2·93	1·46
	Hitchin—Wratten	2·19	2·86	1·32
	,, The Maples	2·22	2·77	1·20
	,, The Chilterns	2·33	2·81	1·34
	,, High Down	2·32	2·81	1·13
THAMES / THAME / 4. Up. Thame	Tring—Pendley Manor	4·06	4·19	1·54
	,, Bulbourne	3·62	3·58	1·49
THAMES / COLNE	Wigginton Vicarage	3·88	3·99	1·53
	Cowroast	3·81	3·98	1·38
6. Bulbourne	Berkhamsted—Fairhill	3·25	3·47	1·30
	,, Rosebank	3·37	3·50	1·38
	,, Rose Cottage	3·34	3·55	1·39
7. Gade	Great Gaddesden Vicarage	3·23	3·17	1·37
	Hemel Hempstead—Apsley Mills	3·58	3·57	1·54
	Kensworth—The Grove	3·49	3·41	1·40
8. Ver	Harpenden—Rothamsted	3·43	3·33	1·46
	St. Albans—Gorhambury	3·59	3·50	1·36
	,, Herts County Museum	3·37	3·37	1·60
	,, Bone Hill	3·08	3·23	1·32
9. Up. Colne	,, Hill End Asylum	2·96	3·14	1·31
	Elstree—Aldenham House	2·84	3·72	1·36
	Watford—Weetwood	3·18	3·36	1·50
	,, London Orphan Asylum	3·05	3·19	1·44
10. Lo. Colne	,, Colne Valley Water Works	2·97	2·88	1·24
	Rickmansworth—Moor Park	3·01	3·06	1·30
	Eastbury—Valeney House	2·69	2·69	1·38
	Northwood—Easby	2·79	2·63	1·53
	Welwyn—Danesbury	2·95	3·20	1·51
12. Mimram	,, Bridge House	3·00	3·26	1·43
	Datchworth Rectory	2·77	3·20	1·37
	Weston—Weston Park	2·33	2·76	1·56
13. Beane	Bennington—Eileen Cottage	2·69	3·00	1·47
	,, Bennington House	2·44	2·82	1·24
	Knebworth—The Manor House	2·77	3·06	1·55
	Therfield Rectory	2·11	2·99	1·64
14. Rib	Throcking Rectory	2·40	3·00	1·49
	Buntingford—Hill Side	2·03	2·89	1·07
	,, Hamels Park	2·48	3·07	1·39
LEA / 15. Ash	Much Hadham	2·39	3·13	1·37
16. Stort	Harlow—Gilston Park	2·57	3·30	1·52
	Hatfield—Holwell House	3·01	3·32	1·45
17. Upper Lea	Hertford—Bayfordbury	2·94	3·48	1·45
	,, Sewage Works	2·30	2·90	1·10
	Ware—Fanhams Hall	2·85	3·00	1·48
	,, Red House	2·50	2·79	1·24
	Hoddesdon—Feildes Weir	2·29	2·51	1·42
	Broxbourne—Stafford House	3·11	2·99	1·67
18. Lower Lea	Northaw—Northacre	3·16	3·32	1·62
	Hadley—Risegate	3·37	3·03	1·81
	Barnet—Summerhill	3·39	2·97	1·60
	New Barnet—Gas Works	3·26	3·04	1·67
Mean for the County		2·87	3·10	1·42

HERTFORDSHIRE IN 1904.

APL.	MAY.	JUNE.	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR.	DAYS.
ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	
·81	1·31	·82	2·99	2·12	1·16	1·25	1·16	1·82	19·37	145
·71	1·60	·83	2·41	2·11	·90	1·13	1·12	1·80	18·37	167
·91	1·64	·86	3·00	2·75	1·01	1·07	1·03	1·79	20·10	142
·96	1·82	·97	2·61	2·78	1·26	1·18	1·48	2·01	21·97	154
·81	1·59	·86	3·78	2·51	1·12	1·13	1·36	2·12	21·65	164
·80	1·53	·81	3·50	2·43	1·10	1·17	1·31	2·05	20·89	145
·84	1·60	·95	3·75	2·44	1·11	1·18	1·34	2·17	21·86	177
·86	1·61	·73	4·13	2·48	1·17	1·12	1·38	1·86	21·60	155
1·30	2·51	1·19	3·37	3·06	1·46	1·51	1·96	2·64	28·79	185
1·24	2·48	1·25	4·06	2·66	1·43	1·33	1·74	2·33	26·91	180
1·35	2·47	1·21	3·59	2·86	1·43	1·26	1·84	2·63	28·04	
1·29	2·44	1·08	3·13	2·61	1·47	1·43	1·91	2·60	27·03	148
1·08	2·32	1·28	3·26	2·08	1·43	1·12	1·64	2·35	24·58	141
1·17	2·27	1·13	3·02	2·18	1·33	1·20	1·66	2·27	24·48	175
1·12	2·30	1·12	3·05	2·10	1·35	1·26	1·75	2·32	24·65	173
1·11	2·36	1·01	3·89	2·35	1·31	1·16	1·65	2·19	24·80	156
1·36	2·41	1·09	3·60	2·43	1·54	1·15	1·69	2·18	26·14	146
1·21	2·36	·90	4·97	2·80	1·26	1·11	1·92	2·47	27·30	140
1·17	2·08	·77	2·86	2·00	1·49	1·31	1·64	2·38	23·92	172
1·21	2·26	·80	3·56	2·05	1·36	1·26	1·68	2·34	24·97	150
1·18	2·22	·95	3·37	2·28	1·58	1·35	1·80	3·09	26·16	174
1·16	2·22	·90	3·77	2·18	1·54	1·31	1·73	2·23	24·67	188
·88	1·79	·82	1·94	2·09	1·35	1·22	1·47	2·09	21·06	
·92	2·10	·98	2·30	2·34	1·36	1·44	1·62	1·90	21·88	157
1·06	2·66	1·00	3·60	2·08	1·59	1·45	1·62	2·32	25·42	182
·98	2·61	1·15	3·46	2·22	1·43	1·48	1·56	2·24	24·81	173
·87	2·23	·95	2·68	1·82	1·14	·93	1·61	2·06	21·38	162
1·09	2·45	·78	2·46	1·98	1·32	1·45	1·52	2·08	22·50	183
1·07	2·30	·83	2·44	2·11	1·42	1·54	1·51	1·95	21·93	164
1·14	2·70	·79	2·49	2·22	1·52	1·58	1·65	2·11	23·15	158
·98	1·98	·73	2·94	2·55	1·33	1·38	1·63	2·19	23·37	161
·94	1·92	·85	2·97	2·50	1·33	1·33	1·70	2·20	23·43	156
·86	2·11	·76	3·75	2·51	1·35	1·23	1·67	2·12	23·70	
·98	1·63	·92	3·22	3·09	1·08	1·39	1·44	2·06	22·46	182
·88	1·78	·84	3·95	2·75	1·25	1·28	1·48	2·13	23·50	177
·80	1·56	·80	3·67	2·51	1·24	1·20	1·51	2·06	21·85	213
1·00	1·85	·95	3·32	2·69	1·32	1·29	1·56	2·23	23·59	151
·93	1·70	1·04	3·00	2·50	1·26	1·32	1·36	1·86	21·71	181
1·01	1·71	·91	3·48	2·49	1·25	1·20	1·54	1·90	22·38	201
·79	1·36	·89	3·07	2·62	1·06	·97	1·28	1·67	19·72	161
·87	1·64	·81	4·08	2·52	1·28	1·29	1·48	1·98	22·89	
·79	1·65	·79	3·18	2·53	1·61	1·28	1·70	1·90	22·32	160
·68	1·81	1·01	2·55	2·39	1·32	1·35	1·89	1·80	22·19	
·64	1·76	·97	3·61	2·20	1·80	1·32	1·64	2·02	23·83	167
·82	1·75	1·30	2·69	2·25	1·64	1·26	1·62	1·90	23·10	174
·58	1·38	·88	2·40	2·51	1·50	1·16	1·48	1·57	19·76	
·95	1·73	1·35	4·32	2·89	1·50	1·35	1·56	1·23	24·41	176
87	1·55	·97	3·31	2·49	1·52	1·23	1·67	1·80	21·94	176
·84	1·84	1·11	2·99	2·41	1·25	1·26	1·75	1·79	21·46	163
1·09	2·11	1·39	3·51	2·30	1·42	1·67	1·91	2·22	25·37	162
·88	2·23	·91	2·76	2·25	1·64	1·52	1·47	2·07	23·83	199
·97	2·16	·84	2·17	2·08	1·46	1·61	1·80	2·00	23·30	196
·99	2·17	·87	2·79	2·21	1·43	1·57	1·79	2·15	23·93	156
·84	2·06	·75	2·18	2·07	1·45	1·56	1·76	1·84	22·48	167
·98	1·99	·95	3·20	2·38	1·38	1·30	1·59	2·11	23·27	167

The first half of the year had 101 days of rain, the second half had 76. There were 55 in the first quarter, 46 in the second, 33 in the third, and 43 in the fourth. During the Winter of 1903–4 there were 55 wet days, during the Spring of 1904 there were 43, during the Summer 30, and during the Autumn 37.

The average number of wet days in each month was as follows :— Jan., 21 ; Feb., 18 ; March, 16 ; April, 11 ; May, 16 ; June, 9 ; July, 10 ; August, 11 ; Sept., 12 ; Oct., 13 ; Nov., 12 ; Dec., 18.

The deviation from the mean for the 30 years 1870–99 was : Jan., + 6 ; Feb., + 5 ; March, + 3 ; April, — 2 ; May, + 4 ; June, — 3 ; July, — 4 ; August, — 3 ; Sept., — 1 ; Oct., — 3 ; Nov., — 4 ; Dec., + 2.

Distribution of the Rainfall throughout the County.—The next table (Table IV) gives the mean fall in each month and in the year in each of the five river-districts represented, and in the two main hydrographical divisions of the county, the catchment-basins of the Great Ouse and of the Thames, and also the difference in the year from the mean for the 20 years 1880–99.

Table IV.—Rainfall in the River-Districts.

Months.	Cam.	Ivel.	Thame.	Colne.	Lea.	Ouse.	Thames.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Jan.	1·87	2·26	3·84	3·25	2·71	2·16	2·99
Feb.	2·59	2·82	3·88	3·24	3·04	2·76	3·16
March	1·39	1·30	1·52	1·40	1·46	1·32	1·44
April	·76	·86	1·27	1·12	·88	·84	1·00
May	1·45	1·63	2·50	2·33	1·81	1·59	2·06
June	·83	·86	1·22	·98	·94	·85	·97
July	2·70	3·46	3·71	3·17	3·17	3·27	3·19
August	2·11	2·56	2·86	2·24	2·47	2·45	2·39
Sept.	1·03	1·13	1·30	1·41	1·39	1·10	1·40
October	1·19	1·14	1·42	1·30	1·33	1·16	1·32
Nov.	1·14	1·32	1·85	1·67	1·61	1·27	1·65
Dec.	1·81	2·00	2·48	2·33	1·95	1·95	2·14
Year	18·87	21·34	27·85	24·44	22·76	20·72	23·71
Diff. from 1880–99	—3·94	—3·10	—0·42	—3·09	—1·99	—3·13	—2·47

The rainfall of the Colne and Lea districts and of the Thames basin approached most nearly to the mean for the county, that of the Cam and Ivel districts and of the Ouse basin was in defect of the county mean, and that of the Thame district in excess.

The mean fall in each of the minor river-districts represented was as follows :—(*Cam*) Rhee, 18·87 ins. ; (*Ivel*) Upper Ivel, 20·10 ins.; Hiz, 21·34 ins. ; (*Thame*) Upper Thame, 27·85 ins. ; (*Colne*) Bulbourne, 25·72 ins. ; Gade, 25·47 ins. ; Ver, 25·40 ins. ; Upper Colne, 21·47 ins. ; Lower Colne, 23·20 ins. ; (*Lea*) Mimram, 23·50 ins. ; Beane, 22·85 ins. ; Rib, 21·42 ins. ; Ash, 22·32 ins. ; Stort, 22·19 ins. ; Upper Lea, 22·37 ins. ; Lower Lea, 23·79 ins.

The rainfall reached at least one inch in 24 hours ending 9 a.m. on three occasions during the year: July 25 and 26, and August 31 ; and exceeded two and a half inches on July 25. At the 50 stations for which we have the daily returns there are in the aggregate 70 records of at least an inch, 7 of which are of at least two inches, and two of these exceed two and a half inches. The heaviest falls were in the Hiz district.

The total yearly fall ranged from 18·37 inches at Odsey to 28·79 inches at Pendley Manor, Tring ; and the total monthly fall from 0·58 inch at Hertford Sewage Works, in April, to 4·19 inches at Pendley Manor, in February. The greatest fall in any one day was 2·71 inches at The Chilterns, Hitchin, on July 25.

Distribution of the Rainfall in each Month.—The nomenclature in the following account of the monthly rainfall is the same as in previous reports, falls of at least $\frac{1}{2}$ inch being styled *considerable*, $\frac{3}{4}$ *very considerable*, 1 inch *great*, $1\frac{1}{4}$ *very great*, $1\frac{1}{2}$ *heavy*, $1\frac{3}{4}$ *very heavy*, and 2 inches *excessive*. Only the fifty returns of the daily rainfall are thus analysed, but the wettest days in each month are given for all stations.

January.—A rather wet month, with rain on many days, and with an almost total absence of snow. On the 27th the rainfall was *considerable* at 6 stations, and on the 30th it was *considerable* at 45 and *very considerable* at one station (Summerhill, Barnet). The 30th was the wettest day at all stations.

February.—Very wet, with rain on many days, and with a little snow on a few days in the middle and towards the end of the month. Nearly all the rain fell during the first half of the month. On the 9th the fall was *considerable* at 45 stations and *very considerable* at one (Datchworth), and on the 12th it was *considerable* at 17 stations and *very considerable* at one (again Datchworth). The 2nd was the wettest day at 2 stations, the 9th at 40, and the 12th at 12.

March.—Rainfall a little below the average, but on more than the average number of days. Snow fell nearly every day for the first week, though never covering the ground to the depth of more than an inch, and there were a few slight falls towards the end of the month. There was no *considerable* fall of rain. The 2nd was the wettest day at 4 stations, the 28th at 49, and the 28th and 29th were the wettest days at one.

April.—A very dry month, with rain on rather less than the average number of days. There was no *considerable* fall. The 12th was the wettest day at 2 stations, the 15th at 4, the 22nd at 47, and the 4th, 5th, and 15th were the wettest days at one. There was a thunderstorm on the 12th in the north of the county.

May.—A month of average rainfall on more than the average number of days. On the 20th the fall was *considerable* at 17 stations, and on the 27th at one station (Moor Park). The 1st was the wettest day at 21 stations, the 20th at 28, the 27th at one station, the 31st at 3 stations, and the 10th and 31st were the wettest days at one station.

June.—A very dry month, with rain on a small number of days. The only *considerable* fall was on the 26th, at 3 stations in the Lea river-basin. The 1st was the wettest day at 3 stations, the 9th at 2, the 14th at 40, the 26th at 8, and the 9th and 14th were the wettest days at one station. There was a slight thunderstorm on the 1st in the west of the county.

July.—Very wet, being the wettest month in the year, but not exceeding the average nearly so greatly as February; with rain on a rather small number of days. On the 25th the fall was at least 0·7 inch at all stations but one, being *considerable* at 3, *very considerable* at 4, *great* at Easby, Northwood (1·06 in.), Eastbury (1·11), New Barnet (1·11), Baldock (1·12), Hadley (1·13), Cowroast (1·14), Danesbury (1·14), Rosebank, Berkhamsted (1·14), Rose Cottage, Berkhamsted (1·14), Hertford Sewage Works (1·15), Northaw (1·16), and Moor Park (1·17); *very great* at Datchworth (1·30 in.), Bridge House, Welwyn (1·32), Red House, Ware (1·34), Fairhill, Berkhamsted (1·35), Knebworth (1·38), and Rothamsted (1·43); *heavy* at Fanhams Hall, Ware (1·51 in.), Wigginton (1·54), Colne Valley Water Works, Watford (1·54), Feildes Weir (1·64), Gorhambury (1·66), Bayfordbury (1·67), Preston (1·69), Great Gaddesden (1·70), Apsley Mills (1·70), the County Museum, St. Albans (1·70), Summerhill, Barnet (1·72), and Bulbourne (1·74); *very heavy* at Aldenham House (1·76 in.), Holwell House, Hatfield (1·76), Broxbourne (1·89), and Weston Park (1·92); and *excessive* at Weetwood, Watford (2·03 ins.), Eileen Cottage, Bennington (2·06), London Orphan Asylum, Watford (2·09), Kensworth (2·12), Bennington House (2·32), High Down, Hitchin (2·52), Bone Hill, St. Albans (2·54), and The Chilterns, Hitchin (2·71). On the 26th it was *considerable* at 4 stations, *very considerable* at 7, and *great* at Eileen Cottage, Bennington (1·04 in.), Datchworth (1·20), and Kensworth (1·22). On the 27th it was *considerable* at 2 stations, *very considerable* at 4, and *great* at Throcking (1·00 in.). On the 30th it was *considerable* at 10 stations, *very considerable* at 13, and *great* at Kensworth (1·01 in.), Great Gaddesden (1·05), and Hamels Park (1·14). The 25th was the wettest day at 48 stations, the 27th at 4, the 28th at one station, and the 30th at one. There were frequent and sometimes rather severe thunderstorms on these days of heavy rain.

August.—A month of average rainfall, with rather fewer wet days than usual. On the 22nd the fall was *considerable* at 17 stations, *very considerable* at 4, and *very great* at Fanhams Hall, Ware (1·30 in.) On the 31st it was at least half an inch at all stations, being *considerable* at 3, *very considerable* at 28, *great* at Hillside, Buntingford (1·00 in.), Hamels Park (1·00), Feildes Weir (1·00), Eileen Cottage, Bennington (1·02), Bennington House (1·02), Summerhill, Barnet (1·02), Preston (1·04), The Chilterns, Hitchin (1·06), Northaw (1·08), Throcking (1·09), Bulbourne (1·10), High Down, Hitchin (1·15), Kensworth (1·16), Odsey (1·20), and Baldock (1·20), and *very great* at Cowroast (1·27 in.), Weston Park (1·33), Wigginton (1·39), and Therfield (1·44). The 22nd

was the wettest day at 2 stations and the 31st at 52. There were thunderstorms on these two days.

September.—A dry month, but with rain on about the average number of days. The only *considerable* fall was on the 30th at one station (Apsley Mills). The 12th was the wettest day at one station, the 14th at 3 stations, the 24th at 5, and the 13th and 14th were the wettest at one station.

October.—Also a dry month, with about the same rainfall as September, but much more in defect of the average; the number of rainy days, also, was below the average, although more than in September; October usually having much rain on many days. There was no *considerable* fall. The 6th was the wettest day at 9 stations, the 16th at 6, the 21st at 34, the 23rd at one station, the 6th and 23rd were the wettest at one station, the 16th and 21st at one, and the 21st and 23rd at 2 stations.

November.—The third dry month in succession, as much below the average as September, but with rather more rain, falling on a small number of days. A little snow fell on a few days about the commencement of the fourth week. On the 7th the rainfall was *considerable* at 20 stations. The 6th was the wettest day at 4 stations, the 7th at 43, the 10th at 6, and the 7th and 10th were the wettest days at one station.

December.—A month of average rainfall on rather more than the usual number of days, two-thirds of which, with nearly all the rain, were in the first half of the month. Snow fell nearly every day during the second week, but not to any considerable depth. On the 6th the rainfall was *considerable* at 11 stations and *very considerable* at one station (Wigginton), on the 9th it was *considerable* at one (Fairhill, Berkhamsted) and *very considerable* at one (the County Museum, St. Albans), and on the 13th it was *considerable* at one (Fairhill). The 6th was the wettest day at 47 stations, the 9th at one station, the 11th at 4 stations, and the 6th and 11th were the wettest days at one station.

Comparison with the Rainfall of the Adjoining Counties.—The rainfall in Hertfordshire continues to be in excess of that of the adjoining counties on the whole, Buckinghamshire alone in 1904 showing an excess over Hertfordshire. The mean rainfall in the year at the same stations as in 1903, except that in two instances stations have been discontinued and others have had to be substituted, was as follows:—Cambridgeshire (21 stations), 18·34 ins.; Bedfordshire (12 stations), 20·75 ins.; Buckinghamshire (18 stations), 23·85 ins.; Middlesex (7 stations), 21·89 ins.; and Essex (33 stations), 18·56 ins.; the mean for the whole of the 91 stations (one to every 40 square miles in each county) being 20·21 ins. This shows that we have been favoured with about three inches, or 13 per cent., more rain than the average in the adjoining counties, which is less in amount, but more in proportion, than in the previous year.

XXIX.

NOTES ON BIRDS OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1904.

By William Bickerton.

Read at Watford, 12th April, 1905.

In my last report I was able to add two additional species to the list of Hertfordshire birds, thus bringing the total to 221. Thanks to information supplied by the Hon. Walter Rothschild, M.P., I am enabled to add two more to the list to-night—the curlew sandpiper (*Tringa subarquata*) and the knot (*Tringa canutus*), several specimens of each of these birds having been seen, and one specimen of each shot, at the Wilstone Reservoir on September 15th, 1904. Of the 223 birds now on our County List, 42 (including the two species added to-night) have been recorded once only for Hertfordshire, while 78 of the 223 have been recorded on less than five occasions.

In accordance with the usual custom, I will give a few particulars of the two new-comers.

1. The Curlew Sandpiper or Pygmy Curlew (*Tringa subarquata*).—This is one of the birds which only visit the British Isles in spring while on their yearly wanderings to their summer breeding haunts, and in autumn on the return journey therefrom. It is much more frequently found on the estuaries of the east coast than on those of our western shores, and the principal influx, mostly of young birds, takes place in August and September. The birds seem to rest for a variable period (sometimes even for three or four months) in our Islands before resuming their journey south.

Down to so recent a period as eight years ago, the nest and eggs of this bird were absolutely unknown to ornithologists, the first having been found on July 3rd, 1897, near the mouth of the Yenisei, away on the shores of Northern Siberia. This is probably its nearest nesting-ground to us, this river forming its western breeding limit.

When the breeding season is over it returns from these high northern latitudes, and it is during such return journeys, as already stated, that it appears in the British Isles. Its journeys are continued south for enormous distances, its winter quarters being found in Cape Colony, in Australia, and even in Tasmania. It is almost an unknown bird in Northern America, and it does not appear to even visit the Arctic portions of that continent for nesting purposes.

2. The Knot (*Tringa canutus*).—This is a very near relation to the one just named, but, unlike the curlew sandpiper, when it comes to us in early autumn it remains with us in great numbers right through the winter until the following May, when it leaves for its breeding-grounds in the far north-west. Like its congener, it is much more partial to the sandbanks and mud-flats of the

east coast estuaries than to corresponding habitats on our western shores. In former times, and, in fact, right down to the end of the seventeenth century, it was captured in nets and systematically fattened for the table.

It is a noteworthy fact that the nest and eggs of this bird are, so far as my reading goes, quite unknown to science, so that even in these wise days we do not know exactly everything, even about a bird that is extremely plentiful all the winter through on the British coasts, and sometimes even, as the present record shows, deigns to visit Hertfordshire.

Its breeding-grounds, however, appear to be chiefly confined to North Greenland and Arctic America. On 30th July, 1876, Colonel Fielden, naturalist to H.M.S. "Alert," first discovered its breeding haunts in Grinnell Land in latitude 82° 33′ N., where he obtained a male and three nestlings near a small lake. Mr. C. Hart, naturalist to the sister ship "Discovery," also captured a brood of four on July 11th, and three others on the next day. A fine group of these is in the Natural History Museum at South Kensington.

Curiously enough, this bird is practically unknown in those regions of Northern Siberia to which the breeding-grounds of the previously-mentioned species are confined, while that bird—the curlew sandpiper—as already mentioned, is almost equally unknown in those northern parts of Arctic America in which alone the young of the knot have been obtained.

In the autumn, as stated, it comes south, and it is found to winter in a southern area so enormous as to include Australia, New Zealand, Cape Colony, and Brazil.

One cannot fail to remark, in passing, on the all but amazing journeys performed by these two birds in their migratory flights of each year. They pass the summer in almost the highest Arctic latitudes—the curlew sandpiper in Asia, the knot in America; then, their busy time being over, they take a journey of something like 8,000 to 10,000 miles to reach the quarters where their instinct tells them they ought to pass the winter. What a journey it must be, especially for the young birds, only three months old, to take! And then back again for another 10,000 miles in spring to their breeding-grounds. Twenty thousand miles travelling a year, and every year, for birds that, even in the adult stage, are only eight inches in length in the case of the curlew sandpiper, and only ten inches in length in the case of the knot, and whose lengths of wing are only 5·1 and 6·5 inches respectively!

So much for the two newly-recorded species. I have now to refer to two birds, each of which has had hitherto only one visit to its credit so far as Hertfordshire is concerned. These are the black redstart and the black-tailed godwit.

Black Redstart (*Ruticilla titys*).—On 28th February, 1904, I started out along the footpath from Watford towards Aldenham, and on approaching the new blacking factory which was then being built just beyond the railway arches, I was astonished to see what

I at first thought was an ordinary redstart (*Ruticilla phœnicurus*) perched on a heap of builders' refuse just within the boundary-wall. On getting nearer, however, I had no difficulty in identifying it as the male black redstart, and I had him under observation for something like ten minutes. He perched on the wall, he perched on the waste-heap, and he perched on a pile of timber that was there, but he never went near either bush, tree, or hedge. Finally he made off down the side of the railway embankment. I might add that a light snow was falling at the time.

This interesting bird was formerly considered very rare in England, but more careful and more extensive observations have established the fact that it visits our southern counties, and especially Devon and Cornwall, every autumn and winter, generally remaining until March or April.

Mr. Howard Saunders states: "It is common in Western Germany, where it arrives about the middle of March, but it is not plentiful in the north-eastern districts. From Holland southward it is, however, abundant in summer, migrating from the countries on the north of the Alps in winter, but becoming more or less sedentary in Southern Europe, and even in the mountains of North Africa, where it breeds at a considerable elevation. Eastward its range appears to extend to the Southern Ural, Asia Minor, and Palestine; in winter to Nubia."

Those of you who have read Mr. W. Warde Fowler's delightful sketches of the bird-life of the Alps will remember that he describes the black redstart as the representative bird of the higher Alpine valleys during the summer months. He further states:—

"The commonest bird of all in the Engelberg valley is one which we seldom see in England, and never in the summer. This is the black redstart, a bird which has a wide summer distribution all over Europe, and is found in Switzerland at all altitudes, suiting itself to all temperatures. Wherever there is a châlet under the eaves of which it can build, there it is to be found as soon as spring has begun to appear, even though the snow is lying all around. I have found it myself nesting in châlets before the herdsmen and cows had arrived there; and at a height of 6,000 feet or more it has woke me at dawn with its song: yet at the same time it is abounding in the plains of France and Germany, and nowhere have I seen greater numbers than in the park at Luxembourg. It is one of the puzzles of ornithology that in spite of this the bird *never* comes to England in the summer, and that the stragglers that do visit us always appear as winter visitants, straying to our foggy shores as if by mistake, when they ought to be on their way to the sunny south.

"The little 'Röthel,' as they call him, is a great favourite with the Swiss peasantry; he is trustful and musical, and will sing sometimes when you are within a few feet of him. They are sorry to part with him in autumn, and cannot make out what becomes of him. One of them told me that twenty-two of these birds were once found in the winter fast asleep in a cluster, like

swarming bees, in the hollow trunk of a cherry-tree: how far the story was mythical I will not venture to say."

It is an ornithological puzzle, too, in another way. There are only two redstarts known in central and western Europe—the redstart and this black redstart. Being so nearly related, we should naturally expect their haunts, their habits, and their respective ranges to correspond. Yet the one, the ordinary redstart, is one of our best known and commonest summer visitors, coming here to breed in fairly large numbers (I may say in passing that during the summer of 1903 I found two nests within 100 yards of the entrance gates to Cassiobury Park, one of them being within ten yards of the footpath), and disappearing entirely in September; while the other, the black redstart, is only known as an autumn and winter straggler, and has never been known to breed in England. Yet in other countries in the summer-time it will breed in some climates that are warmer, as also in others that are cooler than our own.

I have said that this bird has only been once previously recorded for Hertfordshire. This was in March, 1893, when a specimen was seen by Mr. S. Verey at Heronsgate, near Rickmansworth.

Black-tailed Godwit (*Limosa belgica*).—A specimen of this bird was obtained at Tring in 1886. This is the only previous record in our 'Transactions' of this bird having been seen in Hertfordshire. The Hon. Walter Rothschild, M.P., informs me that two birds of this species were seen at the Wilstone Reservoir on 15th September, 1904, and that one of these was taken.

This is another bird belonging to the great Plover and Sandpiper family (Charadriidæ), which now only passes through the British Isles in spring and autumn when on its way to its summer and winter haunts respectively. Formerly, however, it nested in our eastern counties, especially in Yorkshire, Lincolnshire, Cambridgeshire, and Norfolk, eggs being taken in the last-named county until the year 1847. It is by no means numerous at either time of passage. It nests sparingly in Scandinavia and Russia, up to lat. 64° or 65°, plentifully in Poland, and in suitable localities in North Germany, Denmark, Holland, and Belgium. On migration it visits the Canary Islands and Madeira, and its winter quarters extend from the basin of the Mediterranean to as far south as Abyssinia.

Before passing to my general notes, I should like to refer to an interesting point noticed by several of my correspondents. This refers to the increase of albinism among birds during recent years, and especially during last year. Thus Mr. G. E. Bullen, Curator of the County Museum at St. Albans, reports:—

"Variety colouration appears greatly on the increase. Reports of albino varieties of finches, etc., having been noticed frequently, are to hand from many parts of the county. The Hertfordshire Museum has recently acquired a pale variety of chaffinch, shot last year, and other specimens, viz., pale variety yellow bunting and partial albino varieties of common sparrow and hedge-sparrow,

whilst I have in my possession a buff variety of the former—a female killed in October near Bedmond."

Mr. A. W. Dickinson, New Farm, St. Albans, reports that a white chaffinch was seen on January 20th in a field near Harpenden Common, and that a white starling on January 22nd formed one of a flock, and was seen on several occasions extending over a few weeks. Mr. F. W. Headley, M.A., of Haileybury, saw several albino varieties of blackbirds and sparrows. I myself saw a blackbird with a white head near Garston in November, and I may state that it is the only indication of albinism that I have personally noted during my 5½ years residence in the district.

It is especially noteworthy that this tendency towards albinism has been noted by independent observers in different parts of the county, and it would be interesting if one could ascertain whether there has been any corresponding tendency—

(1) Among the smaller mammals of the county, such as the squirrel, weasel, stoat.

(2) Among birds in other counties during the same year.

I now pass to a few general notes.

With regard to the thrush family, there is a general consensus of opinion that song-thrushes (*Turdus musicus*), missel-thrushes (*T. viscivorus*), and blackbirds (*T. merula*) continue to steadily increase, while redwings (*T. iliacus*) and fieldfares (*T. pilaris*), and especially the former, have visited us in much reduced numbers during recent years. One would like to know definitely whether the mild winters of recent years are responsible for the apparent scarcity of the two last named, by allowing these birds to obtain sufficient supplies of food in winter in districts further north. Perhaps the next really hard winter, when it comes, may furnish us with definite evidence on the point.

With regard to the blackbird, I noted a peculiarity in a nest seen near Hamper Mill in March. There had evidently been a "paper chase" out there, just before the bird had built its nest, for it had gathered a number of the white paper "ribbons" which lay about, and woven them into its structure, in every case leaving an inch or two of "ribbon" hanging down the side of the nest. Thus the nest all round presented a highly "decorated" appearance, and one, moreover, which rendered it extremely conspicuous to every passer-by, especially as there were no leaves on the bushes at the time.

Redbreast (*Erithacus rubecula*).—It may be remembered that in my last report I gave an account of a nest containing an altogether abnormal type of egg observed by the Hon. A. Holland-Hibbert at Munden, and that, after weighing up all the evidence afforded by the nest and eggs (the bird itself not having been seen), I came to the conclusion that they were those of the redbreast. I am pleased to be able to report that the gentleman named has again had a nest containing eggs of exactly the same abnormal kind under observation during 1904, and that he has actually seen the bird and identified it, beyond the shadow of doubt, as a robin.

I was again privileged to see both nest and eggs, and I also saw

the bird sitting on its eggs. I have not the least doubt but that they are those of the same bird seen last year. This time the nest was built low down at the side of a rounded evergreen shrub and about 2½ feet from the ground. Last year (1903) it was built right within an evergreen tree, and was entirely screened from view. This time, however, the bird had formed a perfect little look-out for herself at the outer surface of the bush, and could be easily seen as she sat there. The eggs were exactly of the same glossy white appearance and unsymmetrical shape as those described last year, but, strange to say, the nest this year had a well-constructed dome above it, which had been made to fit perfectly into the upper surface of the space in the tree which the nest occupied. In striking contrast to that of last year, too, it was quite neatly and cosily built for a robin, a real little nest, not only from the ornithological but also from the domestic point of view.

Nightingale (*Daulias luscinia*).—This bird was undoubtedly in greater evidence in the Watford district than in the previous year. In connection with its song Mr. F. W. Headley raises an interesting point to which I hope other observers will devote attention during the spring of 1905. He states: "The nightingales are always silent here [Haileybury] from 9 to 10 p.m., or till 10.15. Sometimes they take a rest about 1 a.m., but on warm nights sing without intermission from 10 till dawn. I should like to know whether these singing times are the same in other places."

Chiffchaff (*Phylloscopus rufus*).—This little warbler again appears to have arrived in Hertfordshire both later in time and diminished in numbers, while its near relation, the wood-wren (*Phylloscopus sibilatrix*) only appears once in the year's records. Mr. F. W. Headley states that he did not see or hear the latter at all in 1904, though generally a pair nest near the College. The same observer reports also that the reed-warbler (*Acrocephalus streperus*) did not nest anywhere in his district, though sometimes there are a fair number of nests to be found there.

Of the Grasshopper-Warbler (*Locustella nævia*), Mr. M. Vaughan, M.A., reports that he has not seen or heard a specimen for some years; Mr. Headley that he heard it only once during 1904.

Pied Flycatcher (*Muscicapa atricapilla*).—Mr. M. Vaughan reports that he has only once seen the pied flycatcher in the Haileybury district. That it is a scarce bird in Hertfordshire will be obvious when I state that only five other appearances have been recorded for the county, the last in 1898.

House-Martin (*Chelidon urbica*).—Mr. D. Hill, our Librarian, Herga, Watford, sends an interesting note on this species:—

"About the first week in October, whilst working in my garden, I noticed a pair of house-martins hawking for flies. Seeing that they frequently flew up to the eaves on the north-east side of the house, I went to investigate, and found that they had built a nest there and had hatched off a brood. I watched them daily, and though I could see the young ones' heads peeping out of the

nest every day, found that they only took their first flight on October 21st. There were three young, and they daily, from about 12 to 3, took their flights, accompanied by the old birds, always returning to the nest, until the 29th, when all disappeared, for on the 30th the nest was deserted.

"On November 3rd I saw in the afternoon three martins flying about near the house, but well up in the air, and on November 4th my gardener also saw three. Could these be our three young birds deserted by their parents? If so, what has become of them?

"Is not this a very late date for the young birds to leave the nest, and is not the north-east side of the house rather an unusual position for a nest? A pair also built, early in the summer, on the south-east side of the house, hatched off their young, and disappeared.

"It is singular that though we have occupied this house for twenty years this is the first occasion of martins building here."

Goldfinch (*Carduelis elegans*).—Good news continues to be received as to the increase of this charming little bird. Mr. Vaughan states: "After being reduced almost to vanishing point, goldfinches are certainly increasing in number. I saw several at different places about here."

Tree-Sparrow (*Passer montanus*).—Mr. A. Crossman, in his list of the birds of Hertfordshire, refers to this bird as "a scarce resident." For the first time I have found the bird nesting in the immediate vicinity of Watford during the past year. It so closely resembles the house-sparrow that very careful observation is necessary to distinguish it, and the difficulty is increased by the fact that the house-sparrow, unable to find sufficient domestic accommodation in all the spouts and holes and crannies of all the houses and buildings in all the towns and villages in England, has taken to nesting in trees to a great extent during recent years.

Of the handsome Jay (*Garrulus glandarius*), Mr. M. Vaughan, Haileybury, reports the increasing scarcity, while of its congener the magpie (*Pica rustica*) he states: "I have only seen two near here in 28 years. It used to breed almost in the College grounds." In the Watford district I have seen only one magpie in 5½ years; the jay, however, is pretty common in all our large woods. Both these birds are extremely fond of other birds' eggs, hence their persecution by gamekeepers.

Hooded or Royston Crow (*Corvus cornix*).—Mr. F. W. Headley reports that these winter visitors to our eastern counties are often to be seen in the Haileybury district. In 1904 they first appeared on November 21st. A specimen shot near St. Albans in the autumn is now in the County Museum there. I have never seen this bird in the Watford district.

Greater Spotted Woodpecker (*Dendrocopus major*).—Mr. Vaughan reports that a bird of this rare species flew over the cricket-field at Haileybury on October 14th. For the first time in 5½ years I have had the pleasure of watching one. This was in the Oxhey Woods in November. The green woodpecker (*Gecinus viridis*) is, I feel sure, increasing in the Watford district.

Long-eared Owl (*Asio otus*).—I have heard of a party of four of this comparatively rare species visiting one of the woods near Watford, and I much regret to state that all were shot. It seems almost useless to plead for a cessation of the persecution which has so long and so ruthlessly been directed against our native owls of all species. Not only are they comparatively harmless birds; they are positively beneficial in many respects to the farmer, the agriculturist, and the landowner, by reason of the enormous quantity of small vermin they clear off the land. An incident that was brought to my notice some time ago may illustrate the point. A certain gamekeeper had experienced considerable losses of young pheasants from his coops, and in spite of all his watchfulness he could not discover the cause. One evening at dusk he saw an owl flying round, and naturally enough he fastened on this bird as the cause of all the mischief. He therefore lay in wait, and on the subsequent evening the owl again came wheeling round near the coops, made a sudden swoop down, and rose again with something struggling in his claws. Naturally thinking that he had caught his victim red-handed, the keeper fired and brought down the owl. To his amazement he found that the owl's "quarry" was not, as he had supposed, a young pheasant, but a rat, and that he had therefore taken the life of one of his best helpers and friends.

I am not going to say that an owl will never, and under no circumstances, take a young pheasant or a young partridge. When a pair of owls have a family of hungry owlets to feed, and they are hard put to it for food, I daresay they will pick up a young pheasant or two, or a chicken, if such come in their way. But that owls, even when they have young, regularly and systematically feed on young pheasants, partridges, and chickens, and on nothing else, as some of their persecutors would seem to believe, I totally deny. The great bulk of their food is undoubtedly mice, voles, and rats, as an examination (1) of the "pellets" ejected by them, (2) of the contents of the stomach, has proved over and over again. No; when the owl's account with the farmer and the landowner is balanced up, there is a very big credit balance on the side of the owl, and he ought to be protected as a valuable asset.

Peregrine Falcon (*Falco peregrinus*).—Mr. E. P. Thompson reports that a peregrine was seen to be again haunting the district about the Elstree Reservoir during March. It is worthy of remark that of the eighteen records we now have of the peregrine in Hertfordshire, five are from Elstree.

Kestrel (*Falco tinnunculus*).—Mr. Vaughan (Haileybury) reports: "Hawks are now very scarce. An odd kestrel is all one sees, and it soon meets an untimely fate."

Common Heron (*Ardea cinerea*).—Mr. Headley reports having seen fourteen herons together in the Lea Valley.

Little Bittern (*Ardetta minuta*).—Mr. Vaughan also reports that a specimen of this exceedingly rare visitor was shot not far from Haileybury a few years ago. Although this item does not

belong to the 1904 account, I have thought well to report it, as we have only two other records for our county, one in 1840, the other in 1884.

Wild Geese.—Mr. E. P. Thompson reports that a flock of wild geese, 55 in number, passed over Elstree on 5th March, 1904, and another 25 shortly afterwards. Seven were also seen on the Reservoir in October. The exact species was not identified.

Corncrake or Landrail (*Crex pratensis*).—This bird has been decidedly scarce in Hertfordshire during recent years. I only heard it once during the summer of 1904. Mr. A. W. Dickinson reports a nest of young landrails having been seen in a clover field on July 6th. Two of them were unfortunately killed by the mowing-machine. Mr. Dickinson also reports the following:—"On November 8th a landrail was caught on a field near Sparrow's Wick Wood. It could not fly, and had doubtless been shot or injured in some way. My sister kept it for about a week, when it died and was sent to the County Museum."

Grey Phalarope (*Phalaropus fulicarius*).—Mr. E. Hartert, the Museum, Tring, reports that a female of this species, in beautiful changing plumage, was shot on the Reservoirs on Nov. 2nd. There are only four previous records for the county, the last in 1891.

Dunlin (*Tringa alpina*).—Mr. Hartert also reports that "dunlins mixed with curlew sandpipers in flights" were seen at Wilstone on September 15th. Two of the dunlins were obtained.

Slavonian Grebe (*Podicipes auritus*).—Mr. H. Lewis, St. Albans, writes: "A Slavonian grebe I had in my possession and lately presented to the County Museum was sent to me in the flesh some twenty years ago. I believe it was killed in the county, though I have no recollection where."

As we have only three previous records of this bird, I have thought it well to include Mr. Lewis's note, although it does not contain a record for 1904.

The following birds are reported as being more common during 1904:—missel-thrush, song-thrush, blackbird, nuthatch, grey wagtail, red-backed shrike, hawfinch, goldfinch, house-sparrow, starling, swift, green woodpecker, ring-dove, partridge; while those reported as being scarcer than usual are: redwing, fieldfare, chiffchaff, willow-wren, wood-wren, grasshopper-warbler, swallow, jay, magpie, nightjar, kestrel, landrail, coot, golden plover, snipe.

Curious Nesting-place.—Mr. H. Lewis reports: "A great-tit's nest was built in an upright iron pipe stuck in the ground in Mr. A. Lewis's garden at Sparrowswick, St. Albans. The nest was about eighteen inches from the top, the pipe being only about $2\frac{1}{2}$ inches in diameter. It is marvellous how the nest was constructed in it."

The cuckoo's egg is reported by Mr. Headley as having been found in the nest of the spotted flycatcher.

In conclusion, I desire to very cordially thank all those who have so kindly sent me notes during the past year. Without their invaluable assistance it would be obviously impossible for me to

give anything like so full or so interesting a record of the happenings in the Bird World in Hertfordshire from year to year.

The list of summer visitors, with dates of arrival, is as follows :—

Species.	Locality.	Date.	Observer.
Redstart	Harpenden	April 13	J. J. Willis.
(*Ruticilla phœnicurus*)	Hitchin	,, 13	A. W. Dawson.
	Oxhey Woods	,, 17	W. Bickerton.
Nightingale	St. Albans	,, 14	H. Lewis.
(*Daulias luscinia*)	Berkhamsted	,, 16	Mrs. E. Mawley.
	Broxbourne	,, 16	Rev. H. P. Waller.
	Batch Wood	,, 17	Miss A. Dickinson.
	Bushey Heath	,, 17	P. J. Barraud.
	Hamper Mill	,, 17	W. Bickerton.
	Watford	,, 17	Mrs. Hopkinson.
Greater Whitethroat	St. Albans	,, 18	H. Lewis.
(*Silvia cinerea*)	Bushey Heath	,, 24	P. J. Barraud.
Lesser Whitethroat	Bushey Heath	,, 20	P. J. Barraud.
(*Silvia curruca*)			
Blackcap	St. Albans	,, 18	H. Lewis.
(*Silvia atricapilla*)			
Garden-Warbler	Bushey Heath	,, 30	P. J. Barraud.
(*Silvia hortensis*)			
Chiffchaff	Bushey Heath	,, 7	P. J. Barraud.
(*Phylloscopus rufus*)	St. Albans	,, 10	H. Lewis.
	Munden, Watford	,, 19	W. Bickerton.
Willow-Wren	Bushey Heath	,, 12	P. J. Barraud.
(*Phylloscopus trochilus*)	Oxhey Woods	,, 14	W. Bickerton.
	St. Albans	,, 17	H. Lewis.
Wood-Wren	Bushey Heath	May 8	P. J. Barraud.
(*Phylloscopus sibilatrix*)			
Sedge-Warbler	Cassiobridge	April 30	W. Bickerton.
(*Acrocephalus phragmitis*)	St. Albans	May 1	H. Lewis.
Yellow Wagtail	,, (New Farm)	April 22	A. W. Dickinson.
(*Motacilla raii*)			
Tree-Pipit	Oxhey Woods	,, 14	W. Bickerton.
(*Anthus trivialis*)	St. Albans	,, 18	H. Lewis.
Spotted Flycatcher	Sawbridgeworth	May 8	H. S. Rivers.
(*Muscicapa grisola*)	Cassiobury Park	,, 8	W. Bickerton.
	Watford	,, 15	Mrs. Bishop.
Swallow	Hatfield	April 2	T. Brown.
(*Hirundo rustica*)	Broxbourne	,, 3	Rev. H. P. Waller.
	Sawbridgeworth	,, 9	H. S. Rivers.
	Elstree	,, 10	E. P. Thompson.
	Harpenden	,, 12	J. J. Willis.
	St. Albans	,, 12	H. Lewis.
	Watford	,, 13	Mrs. Hopkinson.
	Bushey Heath	,, 16	P. J. Barraud.
	Berkhamsted	,, 17	Mrs. E. Mawley.
	Munden, Watford	,, 26	W. Bickerton.
(Last seen)	Berkhamsted	Oct. 4	Mrs. E. Mawley.
	Watford	,, 4	Mrs. Hopkinson.
	Sawbridgeworth	,, 8	H. S. Rivers.
	St. Albans	,, 9	Miss A. Dickinson.
House-Martin	Watford	May 3	W. Bickerton.
(*Chelidon urbica*)	Bushey Heath	,, 3	P. J. Barraud.
	St. Albans	,, 10	H. Lewis.
(Last seen)	Watford	Nov. 4	D. Hill.
	Broxbourne	,, 9	Rev. H. P. Waller

Species.	Locality.	Date.	Observer.
Swift	St. Albans	May 11	H. Lewis.
(*Cypselus apus*)	Watford	,, 14	W. Bickerton.
(Last seen)	St. Albans	Aug. 18	H. Lewis.
	Watford	,, 19	W. Bickerton.
Nightjar	New Farm, St. A.	May 19	Miss A. Dickinson.
(*Caprimulgus europæus*)			
Wryneck	St. Albans	April 14	H. Lewis.
(*Iynx torquilla*)	,, (New Farm)	,, 14	A. W. Dickinson.
	Bushey Heath	,, 15	P. J. Barraud.
Cuckoo	St. Albans	,, 12	Miss A. Dickinson.
(*Cuculus canorus*)	Broxbourne	,, 13	Rev. H. P. Waller.
	Watford	,, 13	Mrs. Hopkinson.
	Bushey Heath	,, 14	P. J. Barraud.
	Hatfield	,, 15	Miss R. Blackett.
	Harpenden	,, 15	J. J. Willis.
	Hitchin	,, 15	A. W. Dawson.
	Elstree	,, 16	E. P. Thompson.
	St. Albans	,, 16	H. Lewis.
	,, (New Farm)	,, 16	A. W. Dickinson.
	Sawbridgeworth	,, 16	H. S. Rivers.
	Hamper Mill	,, 17	W. Bickerton.
	Berkhamsted	,, 17	Mrs. E. Mawley.
Turtle-Dove	New Farm, St. A.	May 5	A. W. Dickinson.
(*Turtur communis*)			
Landrail	St. Albans	,, 12	H. Lewis.
(*Crex pratensis*)	,, (New Farm)	,, 13	A. W. Dickinson.

XXX.

REPORT ON PHENOLOGICAL PHENOMENA OBSERVED IN HERTFORDSHIRE DURING THE YEAR 1904.

By Edward Mawley, Past-Pres. R. Met. Soc., F.R.H.S., V.M.H.

Read at Watford, 12th April, 1905.

It is a matter for regret that the north-east portion of the county should still remain altogether unrepresented in our Phenological Report. On the other hand, we welcome with pleasure a new observer at St. Albans, where a vacancy had occurred, and another new observer at Hatfield, where an observer of long standing is this year, much to our regret, leaving the neighbourhood.

The following table gives the list of observers, the districts they represent, and the approximate height of the stations above sea-level. Three of the stations are just outside our County boundary, Harefield being in Middlesex, Chesham in Bucks, and Odsey in Cambridgeshire. The sequence is from south to north.

Station.	Height above Sea-level.	Observer.
Harefield (The Scrubbs)	340 feet.	G. E. Eland.
Watford (The Platts)	240 ,,	Mrs. G. E. Bishop.
Watford (Weetwood)	270 ,,	Mrs. J. Hopkinson.
Chesham (Cannon Mill Cottage)	300 ,,	Miss G. Keating.
Broxbourne	120 ,,	Rev. H. P. Waller.
St. Albans (Worley Road)	300 ,,	H. Lewis.
St. Albans (New Farm)	400 ,,	Miss A. Dickinson.
Berkhamsted (Rosebank)	400 ,,	Mrs. E. Mawley.
Hatfield (Symonds Hyde)	300 ,,	T. Brown.
Hatfield (St. Michael's)	380 ,,	Miss R. Blackett.
Hertford	140 ,,	W. Graveson.
Sawbridgeworth	240 ,,	H. S. Rivers.
Harpenden (Hecla Villa)	370 ,,	J. J. Willis.
Hitchin	230 ,,	A. W. Dawson, M.A.
Odsey, Ashwell	260 ,,	H. G. Fordham.

The Winter of 1903–4.

Taken as a whole this was a Winter of about average temperature. During the course of it there occurred three periods of cold weather, but in each case they lasted only about a week. The greatest cold registered by the exposed thermometer at Berkhamsted was 16 degrees of frost, which is a very high extreme minimum for the season. The rainfall was a good deal in excess of the average; the most noteworthy feature, however, was a wet period in the middle of the quarter, when in 26 days more rain fell than the

average quantity for any two winter months taken together. At Berkhamsted the sun shone for about half an hour a day short of its seasonable duration, making this the most gloomy Winter I have yet recorded.

It is seldom that farmers have had to contend against such trying conditions in regard to weather as those which prevailed during this Winter. In the first place the autumn rains had left the land in a sodden condition, and the early part of December being also wet, it was with the greatest difficulty, and under by no means favourable circumstances, that any corn could be got in at all during that month. Even so late as the third week in December comparatively little wheat had been sown in some parts of the county, owing to the saturated condition of the ground. Indeed, the only period which was at all suitable was for a short time in the middle of November; so that the total area planted with winter corn last year must have been one of the smallest on record. Then in January and February the rain was so persistent that little progress could be made with ploughing the land for spring corn. It can therefore be imagined how considerable must have become the arrears of seasonable work on the farm at the end of the Winter we are now reviewing.

To the horticulturist the season was almost equally unpropitious. For the planting of fruit and other trees and shrubs the soil was for the most part in as unsuitable condition as it well could be, while the preparation of the land for seed-sowing and other purposes was at the termination of the quarter nearly as backward as on the farms. Trees of all kinds were benefited by the plentiful supply of moisture at their roots after so many dry seasons. Fruit-trees, owing to the coldness of the previous Summer, had not made much growth, but the new shoots were sturdy and well nourished. The mild and wet weather also suited the supply of green vegetables, but there were fewer survivals than usual in the way of flowers early in the season, owing to the frosts and drenching rains at the end of the Autumn and the beginning of December.

In my garden at Berkhamsted the winter aconite first showed an open flower on the 13th of January, or a week earlier than its average date in the previous fifteen years. As showing the general mildness of the first half of the Winter, it may be stated that the last rose bloom of the season, growing on a plant in the open ground, was not destroyed by frost until the 17th of that month, which is thirty-seven days later than the average date of its destruction in the preceding eighteen years, and eleven days later than in any of those years.

Taking the county as a whole, the first fertile flowers appeared on the hazel thirteen days later than their average date for the previous twenty-eight years. The song-thrush was first heard after the beginning of the year seven days in advance of its mean date, while the honey-bee was first seen to visit flowers twenty-seven days later than usual.

The Spring.

This was a fairly genial Spring. As regards temperature it was chiefly remarkable for the absence of any very unusual cold or heat. For instance, at no time did the thermometer exposed on the lawn at Berkhamsted show more than 13 degrees of frost in March, or more than 5 degrees of frost in either April or May. The rainfall was only moderate, but the falls were so evenly distributed over the quarter as not to allow the ground to become at any time injuriously dry. The record of bright sunshine at Berkhamsted fell short of the average by very nearly three-quarters of an hour a day. During the last two months of the season there was a striking absence of easterly winds.

After the heavy rains in February, the frost which set in at the end of that month and lasted about ten days proved of much service in improving, at all events, the surface of the soil, but, as the land still remained tough and wet at a few inches deep, it was only with much labour and difficulty that anything like a good tilth was obtainable for the sowing of spring corn. As the season advanced the condition of the ground improved, so that, when the last sowing took place in the middle of April, the land was in a more workable state than at any time during the Autumn or Winter. From that time all went well, and the preparation of the ground for the planting of potatoes and the sowing of mangolds, turnips, and swedes, was carried out with little interruption, with the result that an excellent seed-bed was ultimately obtained for them. During the greater part of the season the grass in the meadows made but little growth. But with warmer nights and a welcome rainfall in the latter half of May good progress was made, so that at the end of the Spring there was every prospect of an excellent crop of hay. The change to warmer and moister weather, which took place at that time, also improved the appearance of the pastures, as well as that of the corn and other crops.

By the middle of March the soil in the garden had so far recovered from the effect of the previous heavy rains that the planting of trees, shrubs, etc., could be carried out under more favourable conditions than at any time since the Autumn, while the absence of frost favoured the green vegetables, of which there was an unusually good supply throughout the season. The fruit-trees flowered late, but in most cases very abundantly, and the unusually fine blossoms fortunately escaped all injury from frost or cold winds. Towards the end of the season seeds germinated quickly and regularly, assisted by the light but frequent rains, and the warmer nights.

Mr. Henry Lewis, writing from St. Albans, stated that the hay crop in that district appeared likely to prove a heavy one, with unusually good undergrowth; while our Chesham observer directs attention to the profusion and fineness of the apple blossom in the middle of May.

TABLE I.—DATES OF FLOWERING OF PLANTS OBSERVED IN 1904, WITH THE MEAN DATE FOR 1876–1903.

SPECIES.	HARE-FIELD.	WATFORD.		CHES-HAM.	BROX-BOURNE.	ST. ALBANS (New Farm).	BERK-HAMSTED.	HAT-FIELD (Symons Hyde).	HERT-FORD.	SAW-BRIDGE-WORTH.	HAR-PENDEN.	HITCHIN.	MEAN FOR THE 28 YRS.
		THE PLATTS.	WEET-WOOD.										
Hazel (*Corylus avellana*)	Feb. 28	Feb. 18	Feb. 15	.....	Feb. 5	.....	Feb. 14	Feb. 7	Jan. 24	Feb. 1	Feb. 10	Feb. 18	Jan. 29
Coltsfoot (*Tussilago farfara*)	.....	.....	Mar. 16	Mar. 24	Mar. 15	.....	Mar. 8	.....	Feb. 14	.....	Mar. 16	Mar. 11	Mar. 1
Wood-Anemone (*Anemone nemorosa*)	Apl. 3	.....	Apl. 10	.....	Mar. 20	.....	Apl. 1	Mar. 27	Mar. 24	Apl. 4	Apl. 12	Apl. 1	Mar. 23
Blackthorn (*Prunus spinosa*)	Apl. 18	Apl. 16	Apl. 11	Apl. 16	.....	.....	Apl. 19	Apl. 18	Apl. 17	Apl. 9	Apl. 21	Apl. 14	Apl. 4
Garlic Hedge-Mustard (*Alliaria officinalis*)	Apl. 25	Apl. 23	Apl. 19	May 1	Apl. 17	May 9	Apl. 21	.....	Apl. 17	Apl. 24	Apl. 25	Apl. 18	Apl. 20
Horse-Chestnut (*Æsculus hippocastanum*)	May 6	May 24	May 1	May 11	.....	.....	May 6	May 4	Apl. 28	May 16	May 6	May 2	May 9
Hawthorn (*Cratægus oxyacantha*)	May 17	May 23	May 17	May 18	.....	.....	May 25	May 9	May 8	May 20	May 12	May 6	May 13
White Ox-Eye (*Leucanthemum vulgare*)	May 22	.....	May 18	May 19	.....	.....	May 27	June 1	May 22	.....	June 1	.....	May 20
Dog-Rose (*Rosa canina*)	.....	.....	June 3	May 30	June 6	May 30	May 30	June 3	May 29	.....	June 4	May 21	June 6
Black Knapweed (*Centaurea nigra*)	.....	.....	July 4	July 19	.....	.....	July 15	July 17	July 10	.....	.....	.....	June 26
Harebell (*Campanula rotundifolia*)	.....	.....	.....	.....	.....	.....	July 14	July 17	.....	.....	.....	July 16	July 6
Greater Bindweed (*Convolvulus sepium*)	.....	.....	.....	July 7	.....	July 13	July 9	July 17	July 21	.....	.....	.....	July 9
Ivy (*Hedera helix*)	.....	.....	Sept. 19	Sept. 16	Sept. 16	Oct. 4	Oct. 6	.....	Sept. 18	.....	Oct. 21	.....	Sept. 27

At Hatfield (St. Michael's) the Dog Rose flowered on June 8th, and the Harebell on July 17th.
At Odsey (Ashwell) the Dog Rose flowered on June 1st, and the Ivy on September 22nd.

TABLE II.—EARLIEST DATES OF OBSERVATION OF BIRDS AND INSECTS IN 1904, WITH THE MEAN DATE FOR 1876–1903.

SPECIES.	HARE-FIELD.	WATFORD.		CHES-HAM.	BROX-BOURNE.	ST. ALBANS (New Farm).	BERK-HAMSTED.	HATFIELD.		SAW-BRIDGE-WORTH.	HAR-PENDEN.	ODSEY (Ashwell)	MEAN FOR THE 28 YRS.
		THE PLATTS.	WEET-WOOD.					SYMONS HYDE.	ST. MICH'S.				
BIRDS.													
Song-Thrush (*Turdus musicus*)	.....	Jan. 30	.....	Jan. 17	Jan. 5	.....	Jan. 5	Jan. 14	.....	Jan. 8	Jan. 8	.....	Jan. 17
Swallow (*Hirundo rustica*)	Apl. 25	.....	Apl. 16	Apl. 15	Apl. 3	.....	Apl. 13	Apl. 2	Apl. 14	Apl. 9	Apl. 12	Apl. 12	Apl. 12
Cuckoo (*Cuculus canorus*)	Apl. 15	Apl. 16	Apl. 13	Apl. 15	Apl. 13	Apl. 12	Apl. 17	Apl. 16	Apl. 15	Apl. 16	Apl. 15	.....	Apl. 13
Nightingale (*Daulias luscinia*)	Apl. 16	Apl. 19	Apl. 17	Apl. 21	Apl. 16	Apl. 17	Apl. 16	Apl. 16	Apl. 22	Apl. 18	Apl. 13	Apl. 26	Apl. 15
Spotted Flycatcher (*Muscicapa grisola*)	.....	May 15	.....	.....	.....	.....	.....	May 22	.....	May 8	.....	May 17	May 14 (11 years)
Swallow (last seen) (*Hirundo rustica*)	Oct. 16	.....	Oct. 4	Oct. 1	.....	Oct. 9	Oct. 4	.....	.....	Oct. 8	.....	Oct. 7	Oct. 17 (13 years)
INSECTS.													
Honey-Bee (*Apis mellifica*)	.....	.....	Mar. 7	Feb. 21	Feb. 9	.....	Mar. 8	.....	.....	Mar. 8	.....	.....	Feb. 1
Wasp (*Vespa vulgaris*)	.....	May 14	Apl. 24	.....	May 1	.....	Apl. 17	.....	.....	.....	Apl. 18	.....	Apl. 7
Small White Butterfly (*Pieris rapæ*)	Apl. 25	.....	Apl. 14	Apl. 11	.....	Apl. 11	Apl. 13	.....	Mar. 10	Apl. 18	Apl. 14	.....	Apl. 5
Orange-Tip Butterfly (*Anthocaris cardamines*)	.....	.....	.....	May 17	.....	May 15	May 29	.....	May 13	May 13	.....	.....	May 9
Meadow-Brown Butterfly (*Epinephile janira*)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	May 22

At St. Albans (Worley Road) the Swallow appeared on April 12th, the Cuckoo on April 16th, and the Nightingale on April 17th.
At Hitchin the Song-Thrush appeared on January 5th, the Cuckoo on April 15th, and the Nightingale on April 13th.

The coltsfoot was eleven days late, the wood-anemone ten days late, the blackthorn thirteen days late, the garlic hedge-mustard five days late, the horse-chestnut one day early, the hawthorn thirteen days late, and the white ox-eye six days late.

As had been the case in the previous five years, the spring migrants arrived behind their average dates. The swallow was one day late, the cuckoo three days late, the nightingale four days late, and the flycatcher two days late.

The wasp made its appearance twenty-one days late, the small white butterfly seven days late, and the orange-tip butterfly nine days late.

The Summer.

This season proved on the whole warm, dry, and exceptionally sunny. Taking the three months separately, June was cold and very dry, July very hot and at its close exceptionally wet, while August was chiefly remarkable for its many cold nights and moderate rainfall. Unlike the two previous quarters there was a splendid record of sunshine.

The yield of hay was very good, and was gathered in in excellent condition, and with but little interruption from rain. The dry weather in June and the three weeks drought in July, accompanied as the latter was by great heat, although favouring the hay harvest, proved very trying to all the growing crops, and particularly to the roots and late-sown corn, while the pastures became quite bare. Relief came in the last week in July, when the rainfall was very heavy. Coming as these rains did after nearly three weeks of unbroken heat, rapid growth was consequently made, and from that period there was no check; for during the cooler weather in August the roots and also the grass made good progress, so that the pastures were soon clothed with abundant herbage. As the cereals were hastened into maturity by the forcing weather in July, the corn harvest began earlier than usual and was carried out with scarcely any interruption at all, and in an exceptionally short time. September is usually regarded as the harvest month, but last year nearly the whole crop was got in before the end of the previous month.

As had been the case in the field, so was it in the garden. Good growth was made both in the kitchen and flower garden, and in the latter the flowering season was all that could be wished until the drought and hot weather in July began to make itself felt, when the progress of all vegetation was arrested until after the wet period at the close of that month.

Mr. Willis reports that at Harpenden the first wheat-ear was out of its sheath on June 21st, which is later than in any of the previous twelve years.

He further expresses the opinion that up to the blooming time of the wheat there was a capital promise of a successful harvest, but that the excessive drought in June (I conclude he means July) caused a stagnation in growth. Several crops, he says, did not

recover their normal growth throughout the rest of the season, and the wheat crop was the worst crop harvested since 1879. Root crops and potatoes also suffered from the drought considerably during their early period of growth. On the other hand, he adds, the deep-rooted fruit-trees drew up the reserve water-supply of the previous year's heavy fall, so that they did not suffer from drought, and there was in most cases abundance of fruit.

Mr. Fordham, writing from Odsey, states that the cutting of wheat there began on August 1st, and that of barley three days later, while the harvest was finished on the 29th. Our new observer at St. Albans mentions the unusually abundant and fine blossoms on the wild roses, and the great number of small white butterflies.

The plants on the list which flower during the summer months were, as in the previous quarter, mostly late in coming into blossom. The dog-rose was three days early, the black knapweed eighteen days late, the harebell eleven days late, and the greater bindweed eight days late.

The Autumn.

This was the coldest Autumn since 1896, or for eight years. There was one very cold period in November, when towards the end of the month the exposed thermometer showed 21 degrees of frost, which is with one exception the greatest cold which I have yet recorded at Berkhamsted in that month. It also proved a very dry quarter, the total rainfall being less than half the average amount. The duration of clear sunshine was about a quarter of an hour a day longer than is seasonable.

No sooner had the corn crops been cleared than it was possible to plough up the stubbles and clear the land of weeds, which in the previous wet Autumn and Winter there was never any opportunity of doing. After the great heat in the Summer the ground worked splendidly, and when, later in the season, the sowing of wheat began, an admirable seed-bed was obtained. The importance to farmers, so far as wheat is concerned, in obtaining such a seed-bed, has recently been conclusively proved by Dr. W. N. Shaw, F.R.S., for he has shown that the yield of wheat in one Autumn is very closely connected indeed with the character of the rainfall in the previous Autumn, a dry Autumn being invariably followed by an abundant yield, and a very wet one by a very deficient yield. If this only holds good for another year, the certainty of an abundant wheat harvest during the coming Autumn is assured. The root-crops improved during the Autumn of 1904 beyond all previous expectation, while there was always a plentiful supply of grass in the pastures for the cattle and sheep.

This was also a good season in the garden, at all events until the end of the third week in November, when there came several exceptionally severe frosts for an autumn month. This killed off most of the flowers then open, and arrested the growth of many plants for the rest of the year. Previous to these frosts the

gardens were unusually gay with the blossom of autumn and late summer flowers.

According to the returns of farm produce in Hertfordshire, published by the Board of Agriculture, the yield of wheat was as much as 32 per cent. below the average for the previous ten years, of barley 22 per cent. below, of oats 15 per cent. below, of beans 24 per cent. below, of peas 2 per cent. below, and of mangolds 2 per cent. below the average. On the other hand, potatoes were 9 per cent. above, turnips were 12 per cent. above, hay (from permanent pasture) was 7 per cent. above, and hay (from clover, etc.) 11 per cent. above their respective averages for the same ten years.

The fruit crops, according to the returns sent in to the 'Gardeners' Chronicle,' were, taking the county as a whole, all more or less in excess of the average, except pears and plums, the yield of which was below average.

The last plant on the list, the ivy, came into flower at its average date.

The swallow took its departure five days earlier than its mean date for the previous thirteen years.

FRUIT AND LEAVES

OF THE

PEDUNCULATED AND SESSILE OAK.

XXXI.

THE COMPARATIVE RATE OF GROWTH OF A PEDUNCULATED AND A SESSILE OAK AT BAYFORDBURY, HERTS.

By John Hopkinson, F.L.S., F.G.S., V.P. R. Met. Soc., Assoc. Inst. C. E.

Read at Watford, 12th April, 1905.

PLATE VI.*

John Evelyn, in his 'Silva,' the first book printed by order of the Royal Society (folio, 1664), remarks: "'T is pity that the several kinds of Oak are so rarely known amongst us, that wherever they meet with Quercus, they take it promiscuously for our common Oak, whereas there be many species of that goodly tree, though we shall take notice only of the two which are frequent with us. These are the Quercus urbana, which grows more upright, and, being clean and lighter, is fittest for timber; and the Robur, or Quercus silvestris, which, as the name imports, is of a vast robust and inflexible nature, of an hard black grain, bearing a smaller acorn, and affecting to spread in branches, and to put forth his roots more above ground."

These trees are generally considered to be distinct species, but by some botanists are held to be merely varieties of *Quercus Robur*. Evelyn's "silvestris" has its fruit stalked or pedunculate and its leaves sessile, and is now usually known as *Quercus pedunculata*. It is our common gnarled and spreading forest oak. His "urbana" has its fruit sessile or but very shortly stalked and its leaves with short peduncles, and is now usually known as *Quercus sessiliflora*. It is often seen growing singly. Coleman thus stated its habitat in our county: "Woods, only in those on the highest and most heathy ground; the solitary specimens in our parks and pleasure grounds are mostly planted;" and he gave *pedunculata* as "common" in "woods and hedges." †

Other points of difference between the two trees are that the leaf-buds of *sessiliflora* are larger and more pointed than those of *pedunculata*, and that its leaves are later to fall.

Miller, in his 'Gardener's Dictionary,' made a mistake which caused considerable confusion for some time, stating that our common English oak was *Q. sessiliflora*. This mistake was copied by Hunter in his edition of Evelyn's 'Silva,' and it was corrected by Martyn in his 'Flora Rustica' (1792) and his edition (1807) of Miller's 'Dictionary;' but a mistake once made in two such popular works as the 'Gardener's and Botanist's Dictionary' and Hunter's 'Evelyn' does not die easily.

* The figures on this plate are reproduced from Selby's 'Forest Trees,' pp. 244, 247.

† 'Flora Hertfordiensis,' pp. 267, 268; see also Pryor's 'Flora of Hertfordshire,' p. 372, for localities for *Q. sessiliflora*.

John Ray first mentions these two kinds of oak in the *second* edition of his 'Synopsis' (1696), where he points out certain differences in the timber they produce, saying of *Q. latifolia mas* [*Q. sessiliflora*]: "Lignum ipsum vim adstrictoriam validam obtinent; unde utilia sunt ad fluxum quemcunque sistendum." Lightfoot, in his 'Flora Scotica' (1777), comparing the sessile with the pedunculated oak, says that "the tree itself is more humble, and the timber harder and higher colour'd;" and Sir J. E. Smith, in his 'Flora Britannica' (1804), remarks of *Q. pedunculata*: "Arbor formosa, ligno utilissimo, duro, tenaci;" and of *Q. sessiliflora*: "A priore differt ligno minoris pretii, . . ." Cooper, in the 'Botany of Sussex' (1834), where he says that "the Navy contracts specify that Sussex oak shall be used," controverted the then general opinion that *pedunculata* produced the best timber, and pointed out that the two trees could be identified by their wood, however much worked up, that of *Q. pedunculata* showing in transverse section "a vast multitude of medullary rays" not seen in that of *Q. sessiliflora*, which is so like chestnut that when taken from our old buildings, in which it has been much used and found extremely durable, it has very generally been mistaken for it.

It may be added that from the colour of the wood, *pedunculata* is known to foresters as "white oak," and *sessiliflora* as "red oak"—a distinction not kept up in the timber trade.

Perhaps the most valuable summary we possess of this much-debated question is in Loudon's 'Arboretum' (1838), under the heading "Properties and Uses" of the Oak, where the following statement is made: "In comparing the wood of *Q. pedunculata* and *Q. sessiliflora*, the former is found the most easy to split, and the stiffest and the easiest to break, and yet the most difficult to bend; while the latter has the advantage over the other in toughness and weight." A comparative view of the weights and of the heating powers of the woods when used as fuel is then given from Hartig, as quoted in the 'Dictionnaire des Eaux et Forêts.' (I only give the *weights* arrived at.)

	Q. p. lb.	oz.		*Q. s.* lb.	oz.
The wood, when green, weighs ...	76	13	...	80	5
,, ,, half-dry, weighs ...	65	9	...	67	12
,, ,, perfectly dry, weighs ...	52	13	...	51	10

The results of experiments made by Tredgold are also given as follows:—

	Q. p.	*Q. s.*
Specific gravity	0·807	0·879
Weight of a cubic foot in lbs.	50·47	54·97
Comparative stiffness, or weight that bent the piece 7-20ths of an inch	167	149
Comparative strength, or weight that broke the piece ...	322	350
Cohesive force of a square inch in lbs.	11,592	12,600
Weight of modulus of elasticity in lbs. for a square inch	1,648,958	1,471,256
Comparative toughness	81	108

Each piece was one inch square, and was sustained by supports two feet apart, the weight being applied to the middle of the length.

As a result of these experiments Tredgold concluded that "The strength, elasticity, toughness, and hardness of the sessile-fruited oak would render it superior for ship-building, were it not so inferior in durability between wind and water to the *Q. pedunculata*, or stalk-fruited kind." This last statement, an opinion generally held, has, however, been controverted, but Hartig's experiments afford some ground for it, a wood which contains when green so much moisture that it weighs considerably more than that of *Q. pedunculata*, and when dry rather less, will probably when under water absorb more moisture and consequently be more liable to decay than one which contains comparatively little moisture or sap when green.

A few more-recent opinions may now be quoted. Grigor, in his 'Arboriculture' (1881), says: "The first [*Q. pedunculata*] is the most approved tree, as it produces the best timber. The timber of *sessiliflora* bears a strong resemblance to that of the Spanish chestnut, . . . Its greatest recommendation is that it grows more freely than the other sorts when young, particularly in an inferior soil and situation; but afterwards the difference in the growth of the trees, and in their ultimate size, is hardly perceptible." Stevenson, in 'The Trees of Commerce' (1888), remarks: "The most valuable is the *Q. pedunculata*, a tree remarkable for the zigzag form of its branches, . . . The other species, the *Q. sessiliflora*, is a more free-growing tree, . . . it is a fact that the sessile oak is an inferior wood, one which in some cases is called the 'Chestnut oak,' the wood often being mistaken for chestnut." In the sixth edition of Brown's 'Forester,' by Nisbet (1894), it is stated that *Q. sessiliflora* in durability almost equals *Q. pedunculata*, but is somewhat softer and easier to work, and that when young the timber is of a more open texture than that of the common oak of the same age, but as it becomes older it is found to be nearly as compact and solid as that of the latter. The specific gravity of *pedunculata* is here given as 1·04 when green, and 0·76 when seasoned in the air; and of *sessiliflora* as 1·01 when green, and 0·74 when seasoned, a statement which does not agree with the results of Hartig and Tredgold; while Schlich, in his 'Manual of Forestry' (vol. ii, 1891), differs still more from them in giving the specific gravity of the wood of *pedunculata* as 0·86, and of that of *sessiliflora* as 0·74. Lastly, Professor Boulger, in his useful work on 'Wood' (1902), says that *Quercus pedunculata* is quick-growing, but does not produce so great a length of stem as *sessiliflora*; that the wood is lighter in colour, but "generally more compact, denser, and tougher, and therefore better for purposes where strength is a primary consideration;" and also that *sessiliflora* is "apparently generally less dense in its timber," and "also perhaps more liable to shakes."

The rate of growth of a tree must affect the density of its wood, the slower-growing tree of nearly allied species being at least most

likely to have the closer-grained wood, and such wood ought to be the harder and more durable.* Observations on the rate of growth of these two species or varieties of oak should therefore be of considerable economic importance, and, when such observations have been made in Hertfordshire, they ought, I think, to be brought before our Society with a view to discussion, even if they do not lead to any very definite result.

In the 'Gardeners' Chronicle' for the 4th of March, 1905, Mr. H. Clinton Baker gave a table showing the rate of growth of a tree of *Quercus pedunculata*, grown from an acorn taken from the well-known Panshanger Oak, and of a tree of *Quercus sessiliflora*, grown from an acorn taken from a tree at Woburn, the two oaks growing at Bayfordbury 200 yards apart in sandy loam.

This table is here reproduced.

Year	*Quercus pedunculata*, sown 1811.		*Q. sessiliflora*, sown 1840.	
	Circumference at 3 ft.	Circumference at 5 ft.	Circumference at 3 ft.	Circumference at 5 ft.
	ft. in.	ft. in.	ft. in.	ft. in.
1865	7 0	6 7	1 10	1 8
1869	7 3	6 10	2 6	2 4
1871	7 6	7 0½	2 10	2 7½
1872	7 8	7 2	3 0½	2 10
1878	8 3	7 9	4 2	3 11
1883	8 7	8 1	5 0½	4 8½
1885	8 9	8 2	5 3½	5 0
1893	8 11	8 6	6 8	6 4†
1900	9 7	9 1	8 0	7 7
1904	9 10	9 2½	8 7½	8 1½

Mr. Clinton Baker remarks: "From the above table it appears that the sessile variety is rapidly gaining upon the pedunculate." That is so undoubtedly, but a careful analysis of the table does not indicate that *sessiliflora* has at all ages been a more rapidly-growing tree than *pedunculata*.

The trees are of very different ages, and it is evident that the younger tree ought to increase in circumference more rapidly than the older. For the 39 years over which this table extends it has done so. But at least two other questions arise: (1) What was the rate of growth of the two trees at the same age? (2) What was the rate before the younger tree attained the age at which the older tree was first measured? The answers to these questions are conflicting, and lead to the further question: (3) What is the present tendency of the rate of growth?

It will be noticed that the intervals of measurement have varied greatly, in fact from one year (1871–72) to eight years (1885–93).

* A contrary opinion has frequently been expressed. See 'Gardeners' Chronicle,' 29th Jan. and 5th Feb., 1842, and 22nd Sept., 1900.

† 5 ft. 8 ins. and 5 ft. 4 ins. in the original table, but these figures are evidently erroneous, probably being misprints.

This makes the graphic method the most satisfactory one from which a definite idea of the annual rate of growth can be obtained. Then the trees have been measured in two places, at 3 feet and 5 feet from the ground. The proper height at which to measure the circumference of a tree has been discussed before our Society by the Rev. Canon Gee,* and he approved of the late Lord Verulam's "rule of thumb," the height of one's waistcoat-pocket; but the height of each of our waistcoat-pockets varies, and four feet is usually considered to be the proper height. I have therefore taken the average of the two measurements. I have also reduced the circumference to the diameter.

Plotting the radius of the two trees at each measurement from a base-line representing the centre of each tree, on the scale of four inches to the foot, and drawing a line in the form of a curve through the points determined, somewhat freely in order to

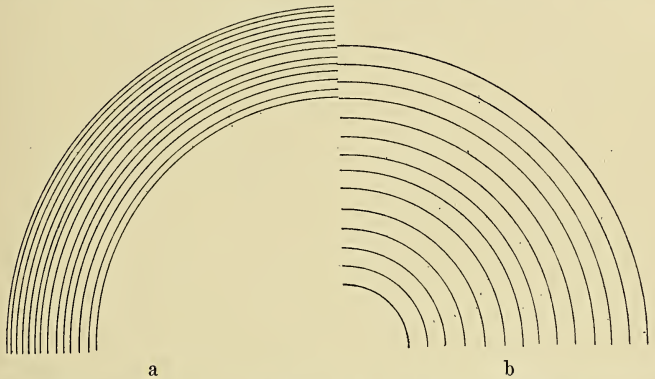


Fig. 25.—Segments of the triennial rings of growth of (a) *Quercus pedunculata* and (b) *Q. sessiliflora* for the 39 years 1865 to 1904.

eliminate certain irregularities which might be due to slight errors in measurement, the diagram now exhibited was drawn (this diagram is not reproduced here). The two long curved lines show the increase in radius of *pedunculata* and *sessiliflora* at four feet from the ground for the 39 years 1865 to 1904. The two shorter curved lines are portions of these superimposed, showing the rate of growth of the two trees at the same ages, from 54 to 64 years of age. These show how *sessiliflora* from the age of 54 to that of 64 has rapidly gained upon *pedunculata*, but they also show that at the age of 54 *pedunculata* had attained a slightly greater diameter than *sessiliflora*. Its growth up to that age was therefore rather more rapid. This is perhaps more evident from the next two diagrams exhibited, which represent the rings of growth of each tree triennially for the whole period, and the annual rings from the 54th to the 64th year of their ages.

* 'Trans. Watford Nat. Hist. Soc.,' Vol. II, p. 7.

Segments of these two diagrams—a quadrant of one and an octant of the other, of each tree—are reproduced here on a much smaller scale as Figs. 25 and 26.

It will be seen (Fig. 25) that while *sessiliflora* has maintained a fairly even rate of growth, the increase of *pedunculata* has varied greatly and was decidedly less during the last half of the period than during the first half; and it is also apparent (Fig. 26) that while the growth of *pedunculata* increased in rapidity from the age of 54 to that of 64, that of *sessiliflora* decreased, although the tendency in *sessiliflora* is still to grow much more rapidly than *pedunculata*.

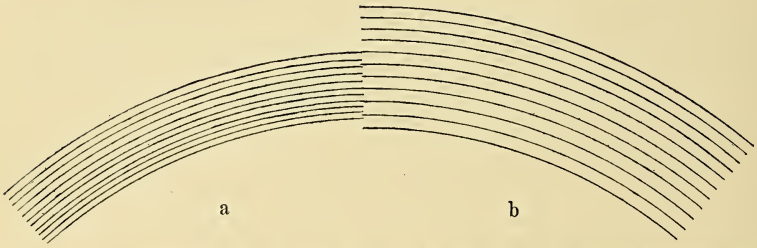


FIG. 26.—Segments of the annual rings of growth of (a) *Quercus pedunculata* and (b) *Q. sessiliflora* from the age of 54 to that of 64.

More definite conclusions might have been arrived at if the trees had been planted at the same time, for the rate of growth must depend somewhat upon meteorological conditions which vary from year to year. Temperature, sunshine, and rainfall are the chief variable climatic factors which influence vegetable growth. The ten years during which each tree has been measured at the same ages is a sufficiently long period to eliminate any appreciable difference in temperature or sunshine, but the case is otherwise with such a fluctuating element as rainfall. I therefore give a table showing the summer, winter, and yearly rainfall at Bayfordbury in decades for the whole period, from which it appears that at the same age *pedunculata* had the advantage of 3 per cent. more summer rainfall (in relation to the 40 years' average) than *sessiliflora*, and 11 per cent. more winter rainfall, giving a mean of 7 per cent. more annual rainfall, notwithstanding which its rate of growth was but little more than half as rapid.

Decade.	Summer, April-Sept.		Winter, Oct.-March.		Year, April-March.	
	Ins.	Ratio	Ins.	Ratio	Ins.	Ratio
1864–65 to 1873–74 ...	11·56	95	13·65	106	25·21	101
1874–75 to 1883–84 ...	14·22	118	13·66	106	27·88	111
1884–85 to 1893–94 ...	11·48	95	12·11	93	23·59	94
1894–95 to 1903–04 ...	11·10	92	12·40	95	23·50	94
Mean	12·09	100	12·95	100	25·04	100

Although this investigation does not lead to any very definite conclusion, results of some value may possibly be arrived at if the measurements are continued, preferably at equal intervals of (say) three years, for many years to come.

The following references may be useful to anyone wishing to look up the literature of this subject. They are restricted to remarks on the comparative density or value of the wood of the two species, or to their rate of growth. I have not thought it necessary to refer to every edition of a work, and have quoted only those which I have seen.

The "Durmast Oak" (the forester's "dunmast," from the dark colour of its acorns) is frequently referred to in this literature. It is a variety of *Quercus sessiliflora*, and has often been confounded with it. It is not recorded to occur in Hertfordshire.

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XXXII.

SOME RECENTLY-EXPOSED BEDS IN THE VALLEY OF THE GADE, AT AND NEAR HUNTON BRIDGE.

By T. E. Lones, M.A., LL.D., B.Sc.

Read at Watford, 12th April, 1905.

During the second half of the year 1904, and the early part of 1905, extensive sewerage excavations were made at Hunton Bridge, and in the district between that village, King's Langley Station, and Abbot's Langley. From a geological point of view the most interesting excavations were seen in Hunton Bridge, and in the fields extending along the western side of the railway from the old Hunton Bridge Gasworks towards King's Langley Station. This paper describes, chiefly, the beds exposed in these excavations, a short account only of the beds exposed in other parts of the district being given. The excavations made in the above-mentioned fields will be called, for the sake of convenience, the Home Park Farm excavations.

The Hunton Bridge and Home Park Farm excavations were made in very wet weather, and, in addition to the surface-waters caused by the heavy rainfall, there was a considerable flow of underground water in the deeper parts of the excavations. The Home Park Farm excavations were equidistant pits, about 20 feet deep, connected by underground tunnels; in other parts of the district the excavations were long open channels.

Fig. 27 represents the beds exposed in the northern part of the Home Park Farm excavations, the length of this part being about 600 yards. The beds were as follows:—1, soil, 4 ins. to 1 ft.; 2, subsoil, 6 ins. to 1 ft.; 3, loam, variable in character, but usually flinty, 1 ft. 6 ins. to 15 ft.; 4, chalk rubble, maximum thickness, 10 ft.; 5, light grey clay, 1 ft.; 6, clean ballast, 4 to 6 ft.; 7, Chalk. It will be seen that the upper surface of the Chalk is very undulating, and that at one part of the section it approaches within 3 feet from the ground-level, but that further south it sinks gradually and then rapidly to a depth of about 23 feet. So sudden was the change at this part, that, while the Chalk could be seen at a depth of about 7 feet in one pit, it was not reached at a depth of 17 feet in the next pit, which was only a few yards away. The depth of the Chalk and the thicknesses of the bottom beds in this part of the excavations were kindly furnished by Mr. Webb, Clerk of the Works, and I am also indebted to him for numerous other measurements, and for many items of information respecting the beds in various parts of the district.

Above the Chalk, in the southern part of the excavations, was a bed of clean ballast, composed mostly of flints and flint-pebbles. A strong current of water flowed continuously through this ballast; the actual direction of the incoming current could not be ascertained

in any of the pits belonging to this section, but the water, as a whole, was flowing towards Hunton Bridge. In a pit excavated beyond the railway bridge, the incoming current seemed to flow obliquely across the line of excavations, and towards the River Gade from the higher ground on the eastern side of the valley. In a few of the pits the flints in the ballast were green-coated, suggesting that they were derived from the bottom bed of the Reading Beds; on the other hand, the ballast drawn from most of the pits was of a reddish-brown colour.

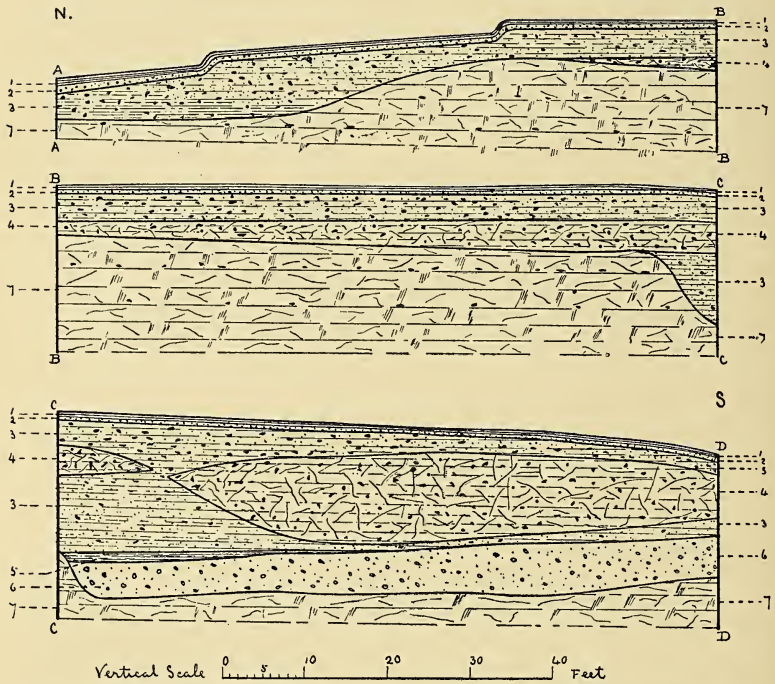

Fig. 27.—Section in the Gade Valley, near Hunton Bridge. Scale 24 ft. = 1 in.

A thin bed of light grey clay, similar to that found in the excavations at the Watford Gasworks, described in Vol. XII, Part 1, of the 'Transactions of the Herts Nat. Hist. Soc.,' rested above the ballast. No fossils were found in this clay.

The beds, denoted in Fig. 27 by means of the reference numeral 3, are very complicated, and consist chiefly of loam, which is very flinty in the upper parts of the beds. In that part of the section in which the ballast and light-grey clay occur, the loam is made up of three beds, an upper light-brown flinty loam, a middle dark-brown loam with only a few flints, and a lower thick sandy loam with a few flints. At the northern end of the excavations the

flinty loam passes into a dark-brown clay, containing unworn flints, and resembling the typical clay-with-flints so closely that it may be rightly regarded as a local deposit of clay-with-flints, occurring at a lower level than usual. The determination of the nature of the beds of loam was rendered difficult by the occurrence therein of two extraordinary deposits of chalk-rubble of variable composition, and consisting mainly of disintegrated chalk, flints, and loam, confusedly mixed together. One of these deposits rested on the Chalk for a long distance, and then extended like a tongue into the loam, so as to separate the lower loam from the upper; the other deposit of chalk-rubble lay within the loam. The existence, in the line of excavations, of two deposits of chalk-rubble which thinned off towards each other, as shown in Fig. 27, admits of no doubt, for one pit was sunk without meeting with any chalk-rubble, while the next pit to the north, and also the next pit to the south, passed through that material, the only difference being that the rubble in the southern was deeper than that in the northern pit.

The soil and subsoil were each about one foot thick at the northern end of the excavations; elsewhere they were very thin. The thinness of the soil and subsoil over the parts where the chalk-rubble occurs, the nature of the chalk-rubble itself, and the fact that much of the chalk débris from the Watford tunnels was deposited at various places between the tunnels and King's Langley Station, might suggest that the chalk-rubble and the beds above it are made ground. This would be an easy way of accounting for the occurrence of so puzzling a set of beds. The way in which the chalk-rubble lies immediately in contact with the Chalk in one part of the excavations and in the loam in the other part, and the fact that no remains of an ancient soil were met with beneath the rubble, make it difficult, however, to believe that the formation of the rubble and the beds above it was not due to natural causes. Mr. Webb also assured me that he found no indication of made ground in this part of the excavations. Beyond the southern end the ballast thinned out, and gave place to a carbonaceous bed, which passed into an extensive peat bed near the Gasworks.

Another peat bed was found in the excavation at the Sewage Pumping Station at Hunton Bridge. This bed was 4 feet thick in one part, but thinned out very rapidly. Beneath the thickest part of the peat was a bed of ballast, and in a few parts of the excavation the ballast was covered by a bed of light-grey clay. These peat beds were described to me by Mr. Webb. A third carbonaceous bed was found opposite and near the "King's Head," Hunton Bridge, and is represented in Fig. 28. The beds exposed were:—1, made ground, about 3 ft.; 2, gravel and sand, about 1 ft. 6 ins.; 3, carbonaceous clay, with remains of wood, leaves, and fresh-water shells, 1 ft. 9 ins.; 4, light-grey clay, 1 ft.; 5, clean ballast, 1 ft. All the shells were very much broken.

In the excavations in Hunton Bridge Road, the Chalk was covered in the higher parts of the road by clay-with-flints, loam, and gravel and sand. In the Upper Highway the excavations were

mainly in Chalk covered by clay-with-flints, but in the lane, from Upper Highway towards Abbot's Langley, bright-coloured loams, clearly derived from pre-existing Reading Beds, were exposed.

Returning to the consideration of the Hunton Bridge and Home Park Farm excavations, it will be admitted that they show (1) the existence of several beds of peat, or other carbonaceous matter; (2) the occurrence of the well-known light-blue clay, evidently derived from pre-existing Reading Beds; (3) the presence of a strong current, or currents, of underground water, flowing through the ballast above the Chalk; and (4) the existence of what seems to be an old river-bed, in the position indicated in Fig. 27. So far as can be ascertained from an examination of the single line of excavations and the contours of the adjacent ground, it would appear probable that this old river-bed lies in the direction of a small, but well-marked, transverse valley, extending from the high ground, on the eastern side of the railway, towards that part of the old river-bed which was seen in the excavations.

The occurrence of the ballast, light-grey clay, and lower part of the loam, is easily explicable on the assumption that the drainage of the district was much greater than it is now, and that lateral feeders ran into the ancient representative of the River Gade. The data are insufficient, however, to furnish a simple explanation of the way in which the chalk-rubble, 4, Fig. 27, was deposited.

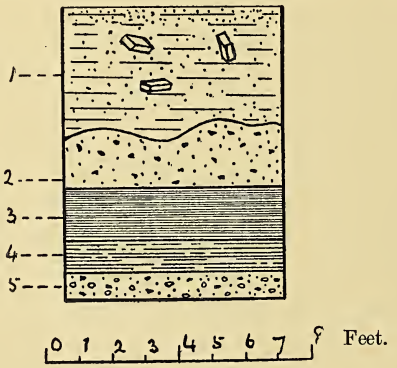

Fig. 28.—Section at Hunton Bridge. Scale 6 ft. = 1 in.

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APPENDIX.

LIST OF MEMBERS

OF THE

HERTFORDSHIRE NATURAL HISTORY SOCIETY AND FIELD CLUB.

SEPTEMBER, 1906.

HONORARY MEMBERS.

Elected	
1875	Avebury, The Right Hon. Lord, P.C., D.C.L., LL.D., F.R.S., F.S.A., F.L.S., F.G.S., F.Z.S.; *High Elms, Farnborough*; 6, *St. James's Square, London, S.W.*; and 15, *Lombard Street, E.C.*
1882	Cooke, M. C., M.A., LL.D., A.L.S.; 53, *Castle Road, Kentish Town, London, N.W.*
1890	Geikie, Sir Archibald, Sc.D., D.C.L., LL.D., F.R.S., F.R.S.E., F.G.S.; 3, *Sloane Court, London, S.W.*
1879	Harting, James Edmund, F.L.S., F.Z.S., Memb. Brit. Orn. Union; *Edgewood, Weybridge.*
1877	Henslow, Rev. George, M.A., F.L.S., F.G.S., Hon. F.R.H.S.; *Drayton House, Leamington.*
1875	Hooker, Sir Joseph Dalton, R.N., G.C.S.I., C.B., M.D., D.C.L. (Oxon.), LL.D. (Cantab.), F.R.S., F.L.S., F.G.S.; *The Camp, Sunningdale, Ascot.*

1900 Hughes, Thomas McKenny, M.A., F.R.S., F.S.A., F.G.S., Professor of Geology in the University of Cambridge; *Trinity College, Cambridge.*

1886 Jackson, Benjamin Daydon, F.L.S., General Secretary of the Linnean Society; *Clevedon, Cautley Avenue, Clapham Common, London, S.W.*

1883 Jones, Thomas Rupert, F.R.S., F.G.S., ex-Professor of Geology at the Royal Military College, Sandhurst; *Penbryn, Chesham Bois Lane, Chesham.*

1904 Mill, Hugh Robert, LL.D., D.Sc., F.R.S.E., Sec.R.Met. Soc.; 62, *Camden Square, London, N.W.*

1880 Sclater, Philip Lutley, M.A., Ph.D., F.R.S., F.L.S., F.G.S., F.Z.S.; *Odiham Priory, Winchfield.*

1896 Wallace, Alfred Russel, LL.D., F.R.S., F.L.S., F.Z.S.; *Broadstone, Wimborne.*

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1895 Massee, George, F.L.S., F.R.M.S., Principal Assistant (Cryptogams), Royal Herbarium, Kew Gardens, Pres. Brit. Mycological Soc.; *Gateacre, Sandycombe Road, Kew.*

1896 Rudler, F. W., I.S.O., F.G.S., M.A.I.; 18, *St. George's Road, Kilburn, London, N.W.*

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1879 Austin, Vernon; *Blairgowrie, Bengeo, Hertford.*

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1894 Cox, Alfred E., M.R.C.S., L.R.C.P.; *High Street, Watford.*

1876 *Croft, Richard Benyon, R.N.; *Fanhams Hall, Ware.*

1878 *Croft, Mrs.; *Fanhams Hall, Ware.*

1894 Curry, Charles Albert; *Woodoaks, Rickmansworth, Herts.*

1904 Earland, Arthur, Hon. Sec. Quekett Microscopical Club; 31, *Denmark Street, Watford.*

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1888 Farries, Thomas; *Garston House, Garston, Watford.*

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1906 Groves, Robert E.; *Hatfield Road, St. Albans.*

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1881 Hill, William, F.G.S.; *The Maples, Hitchin.*
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1875 Holland-Hibbert, Hon. A. H.; *Munden House, Watford.*
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1875 *Hopkinson, Mrs.; *Weetwood, Watford.*
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1894 Johnson, Edmund L.; *Reveley, Bushey Heath, Watford.*
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1904 Kitchin, Vernon P., B.A., F.E.S.; *The Priory, Watford.*

1905 Lamplugh, George W., F.R.S., F.G.S., Geol. Surv. England; 13, *Beaconsfield Road, St. Albans.*
1892 Lewis, Arthur; *Sparrowswick, St. Albans.*
1880 Lewis, Henry; *Worley Road, St. Albans.*
1905 Lewis, H. Langford; *Valency House, Eastbury, Watford.*
1897 Lones, Thomas East, M.A., LL.D., B.Sc.; *Dudley House, Upper Highway, Abbot's Langley.*
1890 *Longman, A. H.; *Shendish, Hemel Hempstead.*
1889 *Loyd, E. H.; *Langleybury, Watford.*
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1875 *Marshall, Frank E., M.A.; *Hawse End, Keswick.*
1890 Mawley, Edward, Sec. R. Met. Soc., F.R.H.S., Sec. Rose Soc.; *Rosebank, Berkhamsted.*
1904 *Morgan, J. Pierpoint, jun.; *Aldenham Abbey, Watford.*
1882 Morison, John, M.D., F.G.S., D.P.H., PRESIDENT; *Thirlestane, St. Peter's Park, St. Albans.*
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1893 Pank, John Lovell; *Somerset Road, New Barnet.*
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1906 Pratt, Frank; *Hazelmere, The Broadway, Watford.*
1906 Pratt, Mrs.; *Hazelmere, The Broadway, Watford.*
1881 *Pryor, Marlborough R., M.A., F.Z.S.; *Weston Manor, Stevenage.*

1881 *Ransom, Francis; *The Chilterns, Hitchin.*
1877 *Ransom, William, F.S.A., F.L.S.; *Fairfield, Hitchin.*
1892 *Riggall, James K.; *Stalheim, Station Road, Watford.*
1906 Robinson, L. E.; 7, *Grosvenor Road, Watford.*
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1899 *Sandeman, Ernest Albert; *Presdales, Ware.*
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1905 Seebohm, Benjamin; *Schallenberg, Avenue Road, St. Albans.*
1883 *Seebohm, Frederick; *The Hermitage, Hitchin.*
1905 Seed, Miss; *Oxhey Lane, Watford.*
1891 Sell, Miss L. C.; *Gartlett, Clarendon Road, Watford.*

1880 Shelly, Charles Edward, M.A., M.D. (Cantab.), M.R.C.S.; *Fore Street, Hertford.*
1883 Sherry, Henry S.; *Dynmore, Watford.*
1893 Slinn, Edward J.; 19, *Park Road, Watford.*
1891 Slocombe, Edward; *Oxhey Warren, Watford.*
1881 Smith, Abel H., M.P.; *Watton, Hertford.*
1905 Smith, Mrs. Arthur King; *Rutherglen, Clarendon Road, Watford.*
1899 Smith, George Francis, M.R.C.S., L.R.C.P. (Lond.); *Clarendon Road, Watford.*
1875 Smith, Joseph G.; *Wiggenhall, Watford.*
1879 Smith, Urban A., Assoc. M. Inst. C. E.; *The Gate House, Hatfield.*
1875 *Smith, W. Lepard; *Ravello, Rosslyn Road, Watford.*
1880 *Smith-Bosanquet, Horace J., F.R.G.S.; *Broxbourne Bury, Hoddesdon.*
1894 Spencer, S. H.; 5, *Rofant Villas, Northwood, Middlesex.*
1899 Sutton, Alfred, Assoc. R.S.M., Hon. Secretary; *Wolstanbury, St. Alban's Road, Watford.*

1875 Thairlwall, F. J.; 12, *Upper Park Road, London, N.W.*
1899 Thompson, Edward Percy; *Elstree, Herts.*

1875 Verini, William; *Birchfield Cottage, Watford.*
1896 Verulam, Right Hon. the Earl of; *Gorhambury, St. Albans.*

1893 Wallen, Frederick; 96, *Gower Street, London, W.C.*
1881 Weall, John, Treasurer; *Rutland Lodge,* and 38, *High Street, Watford.*
1905 Wheelwright, Arthur; 18, *Grosvenor Road, Watford.*
1895 *White, Miss Rose; *St. Andrew's, Church Crescent, St. Albans.*
1881 *Wigram, Miss E.; *Moor Place, Much Hadham, Herts.*
1892 Wilks, E. T., F.R.G.S.; *Ashlyns, Clarendon Road, Watford.*
1894 Williams, W. H.; *Melverley, Alexandra Road, Watford.*
1875 *Wilson, Miss Mary; 4, *Essex Road, Watford.*
1897 Worssam, Henry J.; *Hillside, St. Albans.*

PAST PRESIDENTS.

1875–77. Sir John Evans, K.C.B., D.C.L., LL.D., Sc.D., F.R.S., V.P.S.A., etc.

1877–79. Alfred T. Brett, M.D.

1879–81. J. Gwyn Jeffreys, LL.D., F.R.S., F.L.S., F.G.S.

1881–83. George Rooper, F.Z.S.

1883–85. Right Hon. the Earl Cowper, K.G.

1885–87. Prof. John Attfield, M.A., Ph.D., F.R.S., F.C.S., F.I.C.

1887–89. F. Maule Campbell, F.L.S., F.Z.S., F.R.M.S., F.E.S.

1889–91. Right Hon. the Earl of Clarendon, P.C., G.C.B.

1891–93. John Hopkinson, F.L.S., F.G.S., F.R.M.S., Assoc. Inst. C. E.

1893–95. Arthur Stradling, M.R.C.S., F.Z.S.

1895. Henry Seebohm, F.L.S., F.Z.S., F.R.G.S.

1896–97. Arthur Stradling, M.R.C.S., F.Z.S.

1897–99. William Whitaker, B.A., F.R.S., F.G.S., Assoc. Inst. C. E.

1899–1901. Right Hon. the Earl of Verulam.

1901–3. Lewis Evans, F.S.A., F.R.A.S.

1903–5. B. Daydon Jackson, F.L.S., Gen. Sec. Linn. Soc.

TRUSTEES.

Prof. John Attfield, F.R.S.

John Hopkinson, F.L.S.

W. Lepard Smith.

PROCEEDINGS

OF THE

HERTFORDSHIRE NATURAL HISTORY SOCIETY.

231st Ordinary Meeting, 24th February, 1903, at Watford.

Daniel Hill, F.R.H S., Librarian, in the Chair.

Mr. Alfred E. Cox, M.R.C.S., and Mr. John Hunt were appointed Auditors of the accounts for 1902.

The following papers were read:—

1. "On some Fossiliferous Post-Tertiary Beds exposed at the Gas Works, Watford." By T. E. Lones, M.A., LL.D., B.Sc. (*Transactions*, Vol. XII, pp. 17–20.)

2. "A Review of Hertfordshire Ornithology." By William Bickerton. (*Transactions*, Vol. XII, pp. 26–32.)

3. "Notes on Birds observed in Hertfordshire during the Year 1902." By William Bickerton. (*Transactions*, Vol. XII, pp. 33–40.)

28th Anniversary Meeting, 24th March, 1903.
(At Watford.)

Lewis Evans, F.S.A., F.R.A.S., President, in the Chair.

The Report of the Council for the year 1902, and the Treasurer's Account of Income and Expenditure, were read and adopted.

Alan F. Crossman, F.L.S., F.Z.S., M.B.O.U., Perth, Western Australia, was elected a Corresponding Member of the Society.

The President delivered an Address on "Sun-dials and their Mottoes." (*Transactions*, Vol. XII, pp. 1–16.)
The President exhibited a large number of pocket sun-dials and several books on sun-dials, in illustration of his Address.

The following gentlemen were duly elected as the Officers and Council for the ensuing year:—

President.—B. Daydon Jackson, F.L.S., General Secretary of the Linnean Society.

Vice-Presidents.—John Attfield, M.A., Ph.D., F.R.S., F.C.S., F.I.C.; Sir John Evans, K.C.B., D.C.L., LL D., Sc.D., F.R.S., V.P.S.A., etc.; Lewis Evans, F.S.A., F.R.A.S.; the Right Hon. the Earl of Verulam.

Treasurer.—John Weall.

Honorary Secretaries.—A. E. Gibbs, F.L.S., F.R.H.S.; T. E. Lones, M.A., LL.D., B.Sc.

Editor.—John Hopkinson, F.L.S., F.G.S., F.R.M.S., F.R. Met. Soc., Assoc. Inst. C. E., Sec. Ray Soc.

Librarian.—Daniel Hill, F.R.H.S.

Other Members.—Philip J. Barraud; W. Bickerton; E. T. Burr, F.R.H.S.; W. R. Carter, B.A.; Edward Mawley, V.P.R. Met. Soc., F.R.H.S., Sec. Rose Soc.; G. P. Neele; A. Lestock Reid, M.D.; James K. Riggall; W. Lepard Smith; A. Sutton, Assoc. R.S.M.; W. Whitaker, B.A., F.R.S., F.G.S., Assoc. Inst. C.E.; E. T. Wilks, F.R.G.S.

The thanks of the Society were accorded to Mr. Lewis Evans, retiring from the office of President; to Mr. Alan F. Crossman, retiring from the office of Vice-President; and to Mr. A. E. Ekins, Mr. W. Gruggen, and Mr. George Rooper, retiring from the Council.

Report of the Council for the Year 1902.

The Council of the Hertfordshire Natural History Society, in presenting the 28th Annual Report, regrets to report a decrease in the number of members. During the year one corresponding member, Mr. William Marriott, Assist. Sec. R. Met. Soc., and three ordinary members, were elected; eleven members resigned; and the Council regrets to have to record the loss by death of one of the ordinary members, Mr. Aubrey C. Stoyel, who took great interest in the work of the Society, and had contributed a few short papers to its 'Transactions.'

The census of the Society at the end of the years 1901 and 1902 was as follows:—

	1901.	1902.
Honorary Members	14	14
Corresponding Members	3	4
Life Members	44	44
Annual Subscribers	115	106
	176	168

The following papers or lectures were read or delivered at Watford during the year:—

Jan. 7.—A Journey through Iceland; by Arthur W. Hill, M.A.

March 4.—Anniversary Address—Progress during the Nineteenth Century; by the President, Lewis Evans, F.S.A., F.R.A.S.

March 25.—The Climate of Hertfordshire; by John Hopkinson, F.L.S., F.G.S., F.R. Met. Soc., Assoc. Inst. C.E.

—— Report on Phenological Phenomena observed in Hertfordshire during the Year 1901; by Edward Mawley, Sec. R. Met. Soc., F.R.H.S.

—— Notes on Lepidoptera observed in Hertfordshire during the Year 1901; by A. E. Gibbs, F.L.S., F.R.H.S.

March 25.—Notes on the Fish of the Upper Lea; by James Saunders, A.L.S.

—— Notes on Birds observed in Hertfordshire during the Year 1901; by William Bickerton.

—— Report on the Conference of Delegates to the British Association at Glasgow in 1901; by John Hopkinson, F.L.S., F.G.S., etc.

Nov. 4.—The Geology of North-West Hertfordshire and the adjacent parts of Bedfordshire and Buckinghamshire; by T. E. Lones, M.A., LL.D., B.Sc.

Dec. 16.—On the Habits of some of our Lepidopterous Insects: 1, the Butterflies; by Arthur Cottam, F.R.A.S.

—— On the Shrinkage of the Upper Sources of the River Lea; by James Saunders, A.L.S.

—— Recent Storms and Floods in Hertfordshire; by John Hopkinson, F.L.S., F.G.S., F.R. Met. Soc.

—— The Meteor of the 13th of July, 1902; by John Hopkinson.

—— Historic Trees of Bedfordshire; by William Horley.

The following lectures and paper were given at St. Albans:—

Jan. 16.—Bird-Life in Hertfordshire; by Alan F. Crossman, F.L.S., F.Z.S., M.B.O.U.

March 5.—The Story of our Earth; by James Saunders, A.L.S.

Dec. 2.—Some Further Notes on our County Maps; by H. G. Fordham.

Mr. Hopkinson's annual reports on the Rainfall and on other Meteorological Observations taken in Hertfordshire in the year 1901 have been printed in the 'Transactions' without being brought before a meeting of the Society, as authorized by Rule XVIII.

The following Field Meetings were held during the year:—

April 26.—Kew Gardens.

May 3.—Watford Gas Works, Oxhey Woods, and Harrow Weald.

,, 24.—Harefield.

July 5.—Ayot and Welwyn.

The last of these meetings was held in conjunction with the Geologists' Association.

Three parts of the eleventh volume of the present series of the Society's 'Transactions,' containing 120 pages and one plate, have been issued during the year, completing the papers read during the session 1901–2 and commencing the 'Proceedings' for the session 1900–1. The volume will be completed during the present year.

The additions to the Library consist chiefly, as usual, of publications received in exchange. A list is appended.

The thanks of the Society are due to Mr. T. F. Blackwell for permission to ramble through Oxhey Woods on May 3rd, and to the Watford Urban District Council for the use of the old Board Room for the storage of the Library, and of the Council Chamber for the evening meetings held at Watford.

INCOME AND EXPENDITURE FOR THE YEAR 1902.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Entrance Fees	1	10	0	By Balance, being amount overdrawn	9	11	11
,, Subscriptions for 1898	0	10	0	,, Printing 'Transactions'	39	16	6
,, ,, ,, 1899	0	10	0	,, Miscellaneous Printing	4	5	0
,, ,, ,, 1900	0	10	0	,, Expenses of Meetings	1	1	0
,, ,, ,, 1901	2	10	0	,, Library Expenses	4	16	6
,, ,, ,, 1902	45	10	0	,, Salary of Assistant	5	0	0
,, ,, ,, 1903	6	10	0	,, Postages and Carriage of Parcels	9	12	4
,, Dividends on £130 India 3 per cent. Stock	3	18	0	,, Fire Insurance Premium	0	12	6
,, Sale of 'Transactions' (£6 5*s.* 1*d.*) and 'Flora of Herts' (10*s.*)	6	15	1				
,, Balance, being amount overdrawn	6	12	8				
	£74	15	9		£74	15	9

Amount invested in the purchase of £130 India 3 per cent. Stock . . . . £126 15*s.* 6*d.*

Audited and found correct this 23rd day of March, 1903, { ALFRED E. COX, JOHN HUNT.

Additions to the Library in 1902.

Presented.

British Association for the Advancement of Science. Report for 1901 (Glasgow). 8vo. London, 1902	*The Association.*
British Museum. Catalogue of the Collection of British Bees. 8vo. London, 1902	*The Trustees.*
———. Guide to the Shell and Starfish Galleries. 8vo. London, 1901	,,
Evans, Sir John. Numismatic Society. Anniversary Address. 8vo. London, 1902	*The Author.*
———. The Burning of Bonds under Hadrian. (Numism. Chron., 1902.)	,,
———. On some Rare or Unpublished Roman Coins. (Numism. Chron., 1902.)	,,
———. Egypt Exploration Fund. Address by the President, 1902	,,
Marriott, W. Hints to Meteorological Observers. Ed. 5. 8vo. London, 1902	,,
Symons' Meteorological Magazine. Vol. xxxvii. Feb.–Dec., 1902. 8vo. London	*Dr. H. R. Mill.*

Received in Exchange.

American Museum of Natural History. Bulletin xvii.—Basketry Designs of Indians. Bulletin xviii.—The Araphlu Indians. 8vo. New York, 1902.

Barrow Naturalists' Field Club. Proceedings. Vol. xv. 8vo. Barrow-in-Furness, 1902.

Bath Natural History and Antiquarian Field Club. Proceedings. Vol. x, part 1. 8vo. Bath, 1902.

Birmingham Natural History and Philosophical Society. Proceedings. Vol. xi, part 2. 8vo. Birmingham, 1902.

Boston Society of Natural History. Proceedings. Vol. xxx, Nos. 1 and 2. 8vo. Boston (U.S.A.), 1901.

Bristol Naturalists' Society. Proceedings. N.S. Vol. ix, part 3. 8vo. Bristol, 1902.

Cardiff Naturalists' Society. Transactions. Vol. xxxiii. 8vo. Cardiff, 1902.

Chester Society of Natural Science. Annual Report for 1901–2. 8vo. Chester, 1902.

Croydon Natural History and Scientific Society. Proceedings for 1901–2. 8vo. Croydon, 1902.

Edinburgh. Royal Physical Society. Proceedings. Session 1900–1. 8vo. Edinburgh, 1902.

Glasgow, Natural History Society of. Transactions. N.S. Vol. vi, part 2. 8vo. Glasgow, 1902.

———, Royal Philosophical Society of. Proceedings. Vol. xxxiii. 8vo. Glasgow, 1902.

Hastings and St. Leonards Natural History Society. Ninth Annual Report. 8vo. Hastings, 1902.

London, Geological Society of. Abstracts of the Proceedings. Session 1901–2. 8vo. London, 1902.

———. Geologists' Association. Proceedings. Vol. xvii, parts 6–10. 8vo. London, 1902.

———. Linnean Society. Proceedings. 117th Session. 1901–2. 8vo. London, 1902.

———. Queekett Microscopical Club. Journal. Series 2, vol. viii, Nos. 50, 51. 8vo. London, 1902.

———. Royal Meteorological Society. Quarterly Journal. Vol. xxviii. 8vo. London, 1902.

London. Royal Meteorological Society. Meteorological Record. Vol. xxi, Nos. 82–84; vol. xxii, No. 85. 8vo. London, 1902.

———. Royal Microscopical Society. Journal, 1902. 8vo. London, 1902.

Manchester Field Naturalists' and Archæologists' Society. Proceedings for 1901. 8vo. Manchester, 1902.

——— Geographical Society. Journal. Vol. xvii, parts 8–17. 8vo. Manchester, 1902.

——— Geological and Mining Society. Transactions. Vol. xxii. Supplement, 1896; vol. xxvii, parts 8–12 and Supplement; vol. xxviii, parts 1, 2. 8vo. Manchester, 1902.

——— Literary and Philosophical Society. Memoirs and Proceedings. Vol. xlv, part 1. 8vo. Manchester, 1902.

New York Academy of Sciences. Annals. Vol. xiv, part 2. 8vo. Lancaster, 1902.

——— State Museum. Bulletins. No. 33.—Check List of North American Birds, by E. Orton; No. 34.—Lower Silurian System, by E. R. Cummings; No. 35.—Clays of New York, their Properties and Uses, by H. Reiss; No. 36.—16th Report on Injurious Insects, by E. P. Felt; No. 37.—Illustrated Descriptive Catalogue of Injurious Insects, by E. P. Felt. 8vo. Albany, 1899.

Norfolk and Norwich Naturalists' Society. Transactions. Vol. vii, part 3. 8vo. Norwich, 1902.

Northamptonshire Natural History Society and Field Club. Journal. Vol. xi, Nos. 85–88. 8vo. Northampton, 1902.

North Staffordshire Field Club. Transactions. Vols. xxv and xxvi. 8vo. Stafford, 1901 2.

Philadelphia Academy of Natural Sciences. Proceedings. Vol. liii, part 3; vol. liv, part 1. 8vo. Philadelphia, 1902.

Rugby School Natural History Society. Annual Report for 1901. 8vo. Rugby, 1902.

United States Department of Agriculture. North American Fauna. No. 21.—A Biological Investigation of Hudson's Bay Region. 8vo. Washington, 1902.

——— Geological Survey. 21st Annual Report, for 1899–1900. 4to. Washington, 1901.

——— ———. Reconnaissances in the Cape Nome and Norton Bay Regions, Alaska, in 1900; by A. H. Brooks, etc. 4to. Washington, 1901.

——— ———. The Geology and Mineral Resources of a Portion of the Copper River District, Alaska; by F. C. Schrader and A. C. Spencer. 4to. Washington, 1901.

——— ———. Bulletins. No. 176.—Mineral Resources of the United States for 1900, by T. D. Day; No. 177.—Catalogue and Index of Publications, 1880–1900; No. 178.—The El Paso Tin Deposits, Texas, by W. H. Weed; No. 179.—Bibliography and Catalogue of Fossil Vertebrata of North America; No. 180.—The Occurrence and Distribution of Corundum in the United States, by J. H. Pratt; No. 181.—Results of Primary Triangulation, 1900–1; No. 182.—Report on the Economic Geology of the Silverton Quadrangle, Colorado, by F. L. Ransome; No. 183.—Gazetteer of Porto Rico; No. 184.—Oil- and Gas-Fields of the Western Interior and Northern Texas Coal-Measures and of the Upper Cretaceous and Tertiary of the Western Gulf Coast, by G. I. Adams; No. 185.—Results of Spirit-Levelling, 1900–1; No. 186.—On Pyrite and Marcasite, by H. N. Stokes; No. 187.—Geographic Dictionary of Alaska; No. 188.—Bibliography of North American Geology, Palæontology, Petrology, and Mineralogy for 1892–1900; No. 189.—Index to the above; No. 190.—A Gazetteer of Texas; No. 191.—Bibliography, Synonymy, and Distribution of North American Geologic-Formation Names; No. 192.—A Gazetteer of Cuba; No. 193.—The Geological Relations and Distribution of Platinum and Associated Minerals, by J. F. Kemp; No. 194.—The North-West Boundary of Texas. 8vo. Washington, 1901 (to 184), 1902 (from 185).

Wiltshire Archæological and Natural History Society. Magazine. No. 96. 8vo. Devizes, N.D.
Yorkshire Geological and Polytechnic Society. Proceedings. N.S. Vol. xiv, part 3. 8vo. Leeds, 1902.
——— Naturalists' Union. Transactions. Part 27. The Alga-Flora of Yorkshire, part 1; by W. West and G. S. West. 8vo. Leeds, 1902.

Purchased.

Botany, Journal of. Vol. xl. 8vo. London, 1902.
Nature Notes. Vol. xiii. (*Selborne Society.*) 8vo. London, 1902.
Novitates Zoologicæ. Vol. ix. 8vo. Tring, 1902.
Year-book of the Scientific and Learned Societies of Great Britain and Ireland. . . . 19th Annual Issue. 8vo. London, 1902.
Zoologist. 4th series. Vol. vi. 8vo. London, 1902.

232nd Ordinary Meeting, 21st April, 1903, at Watford.

Edward Mawley, V.P.R. Met. Soc., F.R.H.S., in the Chair.

Mr. J. Brumskill, Gaisgill, Elstree, Herts, was nominated for membership of the Society.

The Chairman read a letter from the Honorary Secretary of the East Herts Archæological Society with reference to Prof. Skeat's forthcoming work on 'The Place-Names of Hertfordshire,' for 25 copies of which the Council, he said, had agreed to subscribe for and on behalf of the members, each member of the Council present at their meeting having undertaken to purchase a copy.

The following papers were read:—

1. "Notes on Lepidoptera observed in Hertfordshire in the Year 1902." By Philip J. Barraud, F.E.S. (*Transactions*, Vol. XII, pp. 21–25.)

2. "Some Hertfordshire Scale-Insects." By John Hopkinson, F.L.S., F.G.S., F.R.M.S. (*Transactions*, Vol. XII, pp. 49–52.)

Lepidoptera were exhibited by Mr. Barraud and scale-insects by Mr. Hopkinson in illustration of their papers.

3. "Report on Phenological Phenomena observed in Hertfordshire during the Year 1902." By Edward Mawley, Vice-Pres.R.Met.Soc., F.R.H.S. (*Transactions*, Vol. XII, pp. 41–48.)

4. "Flowering Plants found around Bushey in 1902." By Miss A. Hibbert-Ware.

The following species were enumerated:— *

Lepidium Draba L. [an alien].—In brickfields, Bushey, in great abundance. New to the Colne district.

Lepidium ruderale L. — In brickfields, Bushey, abundant in September, 1902. Only previously recorded [from the Colne district] as found on cinder heaps by the canal below Rickmansworth.

* The remarks in brackets are by the Editor.

Genista tinctoria L. — At Bushey Station and in brickfields, Bushey, in July, 1902.

Claytonia perfoliata Donn [a casual].—In Merry Hill Lane, Bushey, in fair abundance in June, 1902. [The only previous record for the county is open to doubt. (See Pryor's 'Flora of Hertfordshire,' pp. liii and 167.)]

Bidens cernua L.—In stream in field at bottom of Merry Hill Lane, Bushey.

Cirsium arvense Scop., var. *setosum*.—In brickfields, Bushey. No previous record for the county.

Linaria viscida Moench.—In brickfields, Bushey, in abundance in September, 1902.

Scutellaria minor Huds.—On Herts side of Stanmore Common.

Field Meeting, 16th May, 1903.

CHALFONT ST. GILES.

A little rain was falling when a good party of cyclists assembled at Watford to ride to the Chalfonts and Jordans, places of interest in connection with the lives of John Milton and William Penn.

After debating whether to proceed or not, the majority decided to do so, and rode through Rickmansworth to Maple Cross. The rain had then become so heavy that a halt was called, and the party sheltered for about an hour. In a temporary cessation a start was again made and Chalfont St. Giles was eventually reached, but in drenching rain, and it was decided to have tea there and abandon the further ride to Jordans and round by Chalfont St. Peter.

The Church of St. Giles was visited, approaching it through the old lych-gate under the upper storey of an ancient timbered house, and then through an avenue of yew-trees. It is of much archæological interest. Originally of Norman design, the bases of the Norman pillars in the nave are still to be seen, and the font is Norman. In the churchyard there is the following curious epitaph on the tomb of Timothy Lovett, courier to the 1st Duke of Marlborough:—

"Italy and Spain,
Germany and France,
Have been on earth
My weary dance.
So that I own
Ye grave 's my greatest friend,
That to my travels
All has put an end."

Farther up the village, on the left-hand side, was seen the house where Milton resided during the plague of London in 1665, and in which he finished 'Paradise Lost' and commenced 'Paradise Regained.' It is a half-timbered cottage. About the year 1844 an old porch and a room above it were taken down, and the position of the door was changed. It thus differs in appearance from prints of it of about Milton's time. Thomas Elwood, who took this "pretty box for him at Giles Chalfont," relates that after reading 'Paradise

Lost' he said to his friend, "Thou hast said much here of 'Paradise Lost,' but what hast thou to say of 'Paradise Regained'?" and that on Milton showing him the later poem he said: "This is owing to you, for you put it into my head by the question you put at Chalfont, which before I had not thought of."

The cottage was purchased as the village's Jubilee Memorial of Queen Victoria, Her Majesty contributing towards the cost, and in a room are relics of Milton and old editions of his works.

The return journey was made by Chorley Wood and Loudwater House, still in heavy rain, which ceased only when all had arrived home.

The rainfall this day in the district visited must have exceeded half an inch. In Herts it reached 0·60 in. at Aldenham House and Eastbury, but it was doubtless rather greater in Bucks, and nearly all fell in the afternoon upon our cycling party, more than half of whom were ladies.

Field Meeting, 23rd May, 1903.

THE DUNSTABLE DOWNS.

This meeting, arranged for cyclists only, was held in conjunction with the Geologists' Association, Mr. Hopkinson acting as Director for both the County and the London Society.

Assembling at Tring Station at 3 o'clock, the party proceeded to the picturesque village of Aldbury, which is situated in a pretty valley cut out of the Chalk, after its escarpment commences, by a stream no longer flowing. A fine old timbered house, and the stocks and whipping-post still standing by the side of the village pond, attracted attention; and it was noticed that the hill on the right, where the escarpment commences, is much steeper and rather higher than that on the left, beyond which it ends. The Chalk Rock has been cut through, cropping out near the middle of Moneybury hillside on the right and reappearing near the top of Aldbury Owers on the left.

Beyond Aldbury the road rises considerably, leaving the valley to cross a spur of Pitstone Hill, where it passes over the lower portion of the escarpment, the run down to the plain beyond being very steep. Approaching Ivinghoe, a view of the church invited a closer inspection, and most of the party deviated from the direct route in order to visit it, others examining a pit in the Lower Chalk, in which they waited for the archæologically-diverted members.

Ivinghoe Beacon was then ascended. The summit is nearly 800 feet above sea-level and 200 feet above the road (the Icknield Way), where the bicycles were left. The view from it is very fine, and to-day it was unusually clear. When all had assembled the Director gave an explanation of its geological features. It embraced, he said, the whole of the Cretaceous rocks present on the northern margin of the London Basin except the higher beds of the Upper Chalk. They were standing on or just above the Melbourne Rock,

which forms the base of the Middle Chalk. On the summit of the hills behind them were the lower beds of the Upper Chalk, and for some miles along the Dunstable Downs, as far as the Five Knolls, four of which were distinctly visible, the Chalk Rock could be traced a little below the highest ground, its presence being indicated just beyond the upward termination of the steep face of the escarpment, nearly on level ground, by a slight ridge due to its hardness. Beyond the Five Knolls would be seen Totternhoe Castle Hill, an outlier of the Melbourne Rock forming its summit. Just round the extreme point of the hill were the Totternhoe quarries, where the Lower Chalk is now quarried for lime-burning, but the Totternhoe Stone at the base of the hill, for which the quarries were originally opened, is not now quarried as a building-stone. The position of the Melbourne Rock between Totternhoe Knoll and Ivinghoe Beacon could not easily be traced, as it does not form a distinct feature in the landscape; but there was no difficulty in determining where the Totternhoe Stone occurred, for each little valley or coombe seen at frequent intervals all along the foot of the Downs ended at its base, these valleys in some cases, but not in all, originating in a spring, owing to the water percolating through the Totternhoe Stone and being thrown out by the comparatively impervious Chalk Marl below it. This, he said, extended for some distance from the base of the escarpment, its surface being almost horizontal, and its dip where it is exposed being less than when it passes under the great mass of the Chalk.

Pointing out Eddlesborough Church on an isolated hill, the Director said that that hill was an outlier of the Totternhoe Stone on the Chalk Marl. The next village beyond was Eaton Bray, where a thin band of the Upper Greensand appeared, and at a little greater distance in the same direction Billington Hill with its church could be seen, that being on an outlier of the Lower Chalk over the Gault, of which the greater part of the plain below them consisted. Beyond this, again, the picturesque and well-wooded ridge of the Lower Greensand formed the horizon on the north from Leighton Buzzard for some distance across Bedfordshire towards Sandy and Potton. On the left, to the south-east, the Tring reservoirs, which supply the Grand Junction Canal, were seen, the farthest being on the Gault and the other three on the Charl Marl.

A reference to Mr. Whitaker's paper on Subaërial Denudation was then made, and his arguments in favour of the Chalk escarpment being the result of such denudation and not a sea-cliff were adduced. A view of an isolated terraced hill between the Downs and Eddlesborough, rising in a shallow valley which was traced up to a deep coombe, afforded an opportunity to broach a theory that some lynchets, at least, as these terraces are called, may be the remains of one side of a coombe, the terraces on each being remarkably similar.

On descending the hill a coombe just below it was examined, and its remarkably flat bottom, and regular, clear-cut, side terraces,

were commented upon, a halt being made a little farther on to examine another, the bottom and sides of which are curved. Just beyond the point where the Icknield Way crosses the road from Hemel Hempstead to Leighton Buzzard, a closer inspection of one of these little valleys was made, but this was a true river-valley, and not a dry coombe owing its origin to a time when the water-level in the Chalk was higher than it is now. At its head is a spring rising from beneath the Totternhoe Stone, and along its course other springs arise, for it flows nearly parallel with the strike of the rocks at the base of the Totternhoe Stone. Its sides are steep at first, then much less so, the ridge thus formed being believed to indicate the summit of the Totternhoe Stone, above which the Chalk, being softer, has a more gentle slope.

It was here decided not to go on to Well Head, two miles further on the Icknield Way, where similar phenomena occur on a larger scale, and the return journey was commenced, the Hempstead road being taken as far as Dagnall. The road continues through the "Dagnall gap," as this break in the continuity of the downs may be termed, and meets the head of the River Gade, by the side of which it then runs. It was left at Dagnall, and soon a long ascent commenced to Ringsall, where there is a small outlier of the Reading Beds, one of those farthest removed from the main mass.

On arriving at Little Gaddesden tea was provided at the "Bridgewater Arms," all who started from Tring Station, fifteen in number, partaking of it. On the proposition of the Rev. J. F. Blake a vote of thanks was passed to the Director, and then the return journey was continued through Ashridge Park and over Berkhamsted Common, where the gorse was in full bloom, to Berkhamsted Station. Here one member of the Geologists' Association left the party to return by train, the others cycling on with the Director and Mrs. Hopkinson to their home near Watford, and leaving there after dark for London and elsewhere, one by train, the others cycling.

The weather was perfect, and the route as pretty a one as could well be taken within easy distance of London.

Field Meeting, 27th June, 1903.

KEW GARDENS.

The party, under the direction of the President, Mr. B. Daydon Jackson, Sec. L.S., who has furnished this report, assembled at the main gates of the Gardens facing Kew Green.

The first house visited was the Aroid House, containing also plants whose growth-requirements are similar; thence, passing by Kew Palace and the Old Orangery, the houses devoted to Temperate and Tropical Ferns and the *Hymenophyllum*-annexe were visited; and then the Greenhouse, always worth inspection. Some compartments of the T-range were next gone through, special attention being given to the Orchids, the carnivorous plants, and the Pitcher

plants, these last being accommodated in a side-compartment, the thermometer at the time of the members' visit standing at 91° Fahr. with a saturated atmosphere. The party then walked through the Palm-stove, noticing the collection of Cycads at the north-eastern end, and then an adjournment to the Kiosk was made for tea. On returning, some of the party strolled into the North Gallery, and finally it dispersed at the main entrance, whence it started.

From want of time, the Temperate House and many interesting features of the Gardens were left unvisited.

233rd Ordinary Meeting, 18th November, 1903, at Watford.

B. Daydon Jackson, F.L.S., President, in the Chair.

Mr. J. Brumskill was elected a Member of the Society.

Mr. Henry Kidner, F.G.S., 8, Derby Road, Watford, and the Rev. A. Merle Norman, M.A., D.C.L., LL.D., F.R.S., F.L.S., Honorary Canon of Durham, The Red House, Berkhamsted, were proposed for membership.

The following paper was read:—

"Notes on the Habits of some of our Lepidopterous Insects. Part II.—The Larger Moths." By Arthur Cottam, F.R.A.S. (*Transactions*, Vol. XII, pp. 53–61.)

234th Ordinary Meeting, 16th December, 1903, at Watford.

Professor John Attfield, M.A., Ph.D., F.R.S., etc., Vice-President, in the Chair.

Mr. Henry Kidner, F.G.S., and the Rev. Canon Norman, D.C.L., F.R.S., were elected Members of the Society.

Mr. Arthur Earland, Secretary of the Quekett Microscopical Club, 31, Denmark Street, Watford; Mr. A. H. Foster, The Grange, Hitchin; and Mr. Thomas Frederick Furnival, Honduras Cottage, Bushey Heath, were nominated for membership.

The following lecture was delivered:—

"A Journey amongst the Andes of Upper Peru." By Arthur W. Hill, M.A., Fellow of King's College, Cambridge.

The lecture was illustrated by means of numerous lantern-slides.

235th Ordinary Meeting, 3rd February, 1904, at Watford.

Daniel Hill, F.R.H.S., Librarian, in the Chair.

Mr. Arthur Earland, Mr. A. H. Foster, and Mr. T. F. Furnival were elected Members of the Society.

Mr. John Hunt and Mr. T. F. Furnival were appointed Auditors of the accounts for the year 1903.

The following papers were read:—

1. "Cheese-mites and some other Mites." By John Hopkinson, F.L.S., F.G.S., F.R.M.S., Sec. Ray Soc., etc. (*Transactions*, Vol. XII, pp. 69–72.)

2. "On the Occurrence of *Sirex noctilio* and *Sirex gigas* in Hertfordshire." By A. E. Gibbs, F.L.S., F.R.H.S. (*Transactions*, Vol. XII, pp. 73–76.)

3. "Notes on some Hertfordshire Mammalia." By A. E. Gibbs, F.L.S., F.R.H.S. (*Transactions*, Vol. XII, pp. 135–136.)

Specimens were exhibited by Mr. Gibbs in illustration of his papers; and he also exhibited a bat taken at St. Albans which he believed to be the whiskered bat (*Vespertilio mystacinus*).*

4. "Report on the Conference of Delegates to the British Association at Belfast in 1902." By John Hopkinson, F.L.S., F.G.S., V.P.R. Met. Soc.

The Conference met on the 11th and 16th of September in the Queen's College, Professor W. W. Watts, M.A., presiding at each meeting. Mr. H. George Fordham was the Society's Delegate.

First Meeting.

This meeting was devoted to the Chairman's Address, the consideration of the Report of the Corresponding Societies' Committee, and to a paper entitled "A Plea for a Pigmentation Survey of School Children in Ireland," by Mr. J. F. Tocher.

The Chairman in his Address said that this Conference was the only body which gives a kind of corporate existence and standing to the local Societies as a whole, bringing the Societies into touch with one another, and it was the only hope that at present exists for united action and systematic work. The annual printing of a list of Societies known to be doing important work, with an index of their publications, was a most useful guide to those who were desirous of working up the literature of any area. It was difficult to obtain these publications a few years after date, and the Association had most wisely treasured those which had been sent to it, forming the nucleus of a valuable and unique collection which he hoped would be placed where widely accessible.

The local Societies were especially noted for their wide-reaching aims and the all-embracing list of subjects which they pursue, not less than for the steady, persevering persistence with which they will follow up lines of enquiry often as tedious as they are important. Local facilities or individual genius often placed one Society or other on some bias or enabled it to do brilliant work in some one direction. The force of such example was never lost upon other Societies, which might extend and even amplify the results thus obtained. The Conference had the power, too little

* This was subsequently determined to be a variety of the pipistrelle (*Vesperugo pipistrellus*).

used, to ask for grants and hence to back the requests of the Sections. This should have the effect of helping on those researches which have a local bearing. The Association itself profits in receiving delegates from all over the country, being thus aided in maintaining the cosmopolitanism which is one of its leading characteristics. He would like to see each year at least one delegate bring up some topic which had been treated with conspicuous success by his own Society—not merely a few casual words dropped into a discussion, but a considered paper dealing with the technique of an investigation, its difficulties, and some of the conclusions to which it was leading.

After mentioning with commendation the 'Record of Bare Facts' of the Caradoc and Severn Valley Field Club, Prof. Watts referred to the difficulty of finding the reports of the meetings of provincial Societies in local newspapers, and said that all important papers thus reported should be reprinted and distributed freely to our libraries and scientific institutions. Printing a few extra copies was not expensive when the type was once set. A common vehicle for the publication of the more important papers of the Societies of a county or some other well-defined area ought to be made a success; it would be an untold economy and convenience to the local Societies themselves, and to those who wish to buy and use their publications. The 'Irish Naturalist' was an effort in this direction which had been a conspicuous success for many years.

After alluding to museums, and specially referring to the importance of local Societies retaining a considerable amount of control over the museums which they give up to other authorities such as County and Town Councils, and also mentioning various Committees of the Association carrying on local investigation, Professor Watts concluded his Address with a few words on his own special subject, Geology. In the maps of the first geological survey of the country, now nearing completion, there was, he said, a wealth of raw material for the local investigator. The work of the geological surveyor was only just begun when he had got the lines upon his map; the further division of the strata, the zonal collection of the fossils, the relations and origin of the igneous rocks, and the fascinating problems relating to the origin of the landscape-features, all became for the first time possible with the completion of the 1-inch map. After the survey, new wells, borings, cuttings, quarries, and other sections were opened up, and the local Society could do excellent work, either in the person of the local geologist or by giving information to the office of the Survey.

The difference between superficial and solid geology was pointed out, one dealing with surface-accumulations of drift, gravel, and subsoil, and the other with the rocks built upon the earth's crust, and a third geology, which might be termed abysmal, was alluded to as now becoming prominent, especially for economic reasons, and local Societies were urged to get and keep all records of borings. Finally, the relation of geology and landscape was mentioned as

a line of enquiry which can only be satisfactorily worked out by the local observer, and may be expected to yield many new and important results.

The Report of the Corresponding Societies' Committee stated that the following letter had been issued, with the Report of the Conference of Delegates at Glasgow, to the Secretaries and the Delegates of all the Corresponding Societies:—

"BURLINGTON HOUSE, LONDON, W.

26*th February*, 1902.

"DEAR SIR,

"I herewith send you a copy of the Report of the Conference of Delegates of the Corresponding Societies held at Glasgow. I also enclose a list of the Committees of the Association appointed at that meeting for the investigation of special subjects in which the co-operation of the Corresponding Societies is desired, together with the names and addresses of the Secretaries, to whom you should apply without delay for specific instructions as to how the investigations or work should be carried out by your Society.

"You will be good enough to have the Report communicated to your Society at an early meeting, and to impress upon your members the importance of taking part in the work of as many of these Committees and in the investigation of as many of the subjects selected by the Delegates as possible. To this end it is very desirable that your Society, or the Council thereof, should appoint a Special Committee to consider what work can be done by your Society, and to arrange for its being begun forthwith.

"The observations when made should form interesting communications for your Society, and at the same time assist the work of the Committees of the Association.

"Besides adopting the programme of work proposed by the Delegates for the Corresponding Societies to engage in, my Committee have also resolved to accede to the request of the Delegates to ascertain and report to the next meeting of the Association what work has been done by each of the Corresponding Societies during the year towards the investigation of the subjects specified, and what assistance they have individually rendered to the several Committees of the Association desiring their co-operation. I trust that in that report your Society will be mentioned as having taken an active part.

"I am, yours truly,

J. G. GARSON (Secretary)."

The following are the Committees in whose investigations it is possible for our Society to co-operate:—

1. To investigate the Erratic Blocks of the British Isles, and to take measures for their Preservation: *Secretary*, Professor P. F. Kendall, Yorkshire College, Leeds.

2. For the Collection, Preservation, and Systematic Registration of Photographs of Geological Interest: *Secretary*, Professor W. W. Watts, The University, Birmingham.

3. For the Collection, Preservation, and Systematic Registration of Photographs of Anthropological Interest: *Secretary*, Mr. J. L. Myres, 3, Hanover Square, London, W.

4. For the investigation of the Respiration of Plants: *Secretary*, Mr. H. Wager, Arnold House, Derby.

The following is the list of subjects selected by the Delegates for investigation, all of which except the first it is possible for our Society to investigate:—

1. Coast Erosion: *Referee*, Mr. W. Whitaker, F.R.S., 3, Campden Road, Croydon.
2. Record of Bore-holes, Wells, and Sections: *Referee*, Mr. J. H. Merivale, Togston Hall, Acklington.
3. Underground Fauna: *Referee*, Rev. T. R. R. Stebbing, F.R.S., Ephraim Lodge, The Common, Tunbridge Wells.
4. Variations in the Course of Rivers and Shape of Lakes: *Referee*, Dr. H. R. Mill, 62, Camden Square, London, N.W.
5. Archæological Survey of Counties: *Referee*, Rev. J. O. Bevan, Chillenden Rectory, Dover.
6. Ethnological Survey: *Referee*, The Secretary, Anthropological Institute, 3, Hanover Square, London, W.
7. Botanical Survey of Counties: *Referee*, Dr. W. G. Smith, Yorkshire College, Leeds.
8. Photographic Record of Plants: *Referee*, Mr. A. Coomaraswamy, Walden, Worplesdon, Guildford.

The rest of the Report consisted of a copy of the letter and forms sent to the Corresponding Societies with regard to their retention on the list and the work done by them in the above investigations. Only twelve of the sixty-eight Corresponding Societies gave information of the actual work done by them.

In placing this Report before the Conference, the Secretary, Dr. Garson, gave some particulars of what had been done by the Corresponding Societies in the above fields of research, concluding with the following pertinent remarks:—

"The work of the Corresponding Societies may be considered to be of two kinds, viz.: (1) Educational, by which he meant the diffusion of scientific knowledge among the members; (2) Research or investigation for the elucidation of the hitherto unknown. While everyone would agree that all the Corresponding Societies are doing excellent work in the former department, unfortunately those which take part in the latter kind of work are but few comparatively. Yet it is *local scientific investigation* and publication of the results thereof which the British Association requires of a Society to make it eligible to be placed on the list of the Corresponding Societies. He therefore hoped that the accounts given of the work done during the past year would bring home to many Societies the information wherein their work is defective, and stimulate all the Societies to do more."

After a short discussion Mr. Tocher read his paper before mentioned, and the meeting then adjoined.

Second Meeting.

The representatives of the various sections of the Association brought forward the work of their Committees in which the aid of the Corresponding Societies was desired, and a paper was read by Mr. Charles H. Read, F.S.A., entitled "A Plea for an Ordnance Map Index of Prehistoric Remains."

Besides the plea in that paper the only subject brought forward

which can be considered suitable for investigation by our Society is that of rainfall. Dr. H. R. Mill said that he had more than once had to be grateful to local Societies for important assistance in collecting material for the comprehensive discussion of natural phenomena. There was one way in particular in which he believed the members of local Societies could find interesting occupation sure of leading to useful scientific results. He was devoting himself to the collection and discussion of data relating to the rainfall of the British Isles, and in carrying on what was really a national work, though done by the co-operation of the observers themselves; the chief difficulty had been the constant changes in the stations where observations were made, on account of the death or removal of the observers. This difficulty might to a great extent be obviated if every Scientific Society would make itself responsible (as many already did) for keeping an accurate and continuous record of the fall of rain, or, it might be, a series of records at properly selected places in their own neighbourhood. No element of climate was so variable and apparently so capricious as rainfall; hence the impossibility of having too many gauges, provided they were of good quality, properly placed, and conscientiously observed. No doubt the mere accumulation of records was an unworthy aim, and involved only useless trouble if they were not turned to account. But the rainfall figures were turned to account in the compilation of an annual volume, 'British Rainfall.' On application to him full particulars as to observing and recording rainfall would be sent to anyone interested.

Mr. Read's paper on indexing Prehistoric Remains should be read in the Report of the Association (in our Library) by all who are interested in the subject; but one passage in it may be quoted: "Each Society should record on the large scale Ordnance Map every tumulus or earth-work within the county, and at the same time keep a register of the sites with numbers referring to the map, and in this register should be noted the names of the owner and tenant of the property, as well as any details which would be of use in exploring the tumuli."

The following resolution was passed:—"From communications received relating to the destruction of earth-works and other historic and prehistoric remains, this Conference is rendered sensible of the necessity for the systematic indexing of important anthropological remains, county by county, with a view to their preservation. It therefore commends the collection of material to local Societies, and expresses the hope that steps may be taken to co-ordinate the various elements involved, and to arrange for the publication of the work."

The following resolutions were referred to the Council:—

"That the Council be requested to impress upon His Majesty's Government the desirability of appointing an Inspector of Ancient Monuments under the Ancient Monuments Act in the place of the late Lieut.-General Pitt-Rivers."

"That the Council be requested to call the attention of His Majesty's Government to the destruction of Ancient Monuments, especially on Dartmoor, which is authorized under the terms of the Highway Act, 5 & 6 Wm. IV, c. 50, the provisions of which are unrepealed by later Acts; and to urge the repeal of this section of the Act."

29th Anniversary Meeting, 1st March, 1904.
(At Watford.)

B. Daydon Jackson, F.L.S., President, in the Chair.

The Report of the Council for the Year 1903, and the Treasurer's Account of Income and Expenditure, were read and adopted.

Hugh Robert Mill, LL.D., D.Sc., F.R.S.E., Sec. R. Met. Soc., F.R.G.S., 62, Camden Square, London, N.W., was elected an Honorary Member of the Society.

The President delivered an Address on "Some Hertfordshire Naturalists and their Work." (*Transactions*, Vol. XII, pp. 77–88.)

The following gentlemen were duly elected as the Officers and Council for the ensuing year:—

President.—B. Daydon Jackson, F.L.S., General Secretary of the Linnean Society.

Vice-Presidents.—Sir John Evans, K.C.B., D.C.L., LL.D., Sc.D., F.R.S., V.P.S.A., etc.; Lewis Evans, F.S.A., F.R.A.S.; Edward Mawley, F.R.Met.Soc., V.P.R.Met.Soc., F.R.H.S., Sec. Rose Soc.; the Right Hon. the Earl of Verulam.

Treasurer.—John Weall.

Honorary Secretaries.—A. E. Gibbs, F.L.S., F.R.H.S.; Arthur Sutton, Assoc. R.S.M.

Editor.—John Hopkinson, F.L.S., F.G.S., F.R.M.S., V.P.R.Met. Soc., Assoc. Inst. C.E., Sec. Ray Soc.

Librarian.—Daniel Hill, F.R.H.S.

Other Members.—John Attfield, M.A., Ph.D., F.R.S., F.C.S., F.I.C.; Philip J. Barraud, F.E.S.; W. Bickerton; E. T. Burr, F.R.H.S.; W. R. Carter, B.A.; Alfred E. Cox, M.R.C.S., L.R.C.P.; Arthur E. Ekins, F.C.S., F.I.C.; Henry Kidner, F.G.S.; T. E. Lones, M.A., LL.D., B.Sc.; G. P. Neele; W. Lepard Smith; W. Whitaker, B.A., F.R.S., F.G.S., Assoc. Inst. C.E.

The thanks of the Society were accorded to Dr. T. E. Lones, retiring from the office of Honorary Secretary; to Dr. John Attfield, F.R.S., retiring from the office of Vice-President; and to Dr. A. Lestock Reid, Mr. J. K. Riggall, and Mr. E. T. Wilks, retiring from the Council.

Report of the Council for the Year 1903.

The Council of the Hertfordshire Natural History Society, in presenting the 29th Annual Report, regrets again to announce a decrease in the number of members. During the year one ordinary member, Mr. Alan F. Crossman, F.L.S., has been elected a corresponding member; three ordinary members have been elected; seven members have resigned; one member has been struck off the list on account of non-payment of subscription for three years; and the Council regrets to have to record the loss by death of two honorary members, Mr. Robert Etheridge, F.R.S., and Mr. James Glaisher, F.R.S.; two life members, the Most Honourable the Marquis of Salisbury, K.G., F.R S., and the Rev. John Wardale, M.A.; and two ordinary members, Sir Charles Nicholson, Bart., M.D., and Mr. T. Vaughan Roberts.

Mr. Etheridge was born on the 3rd of December, 1819, at Ross, in Herefordshire. In 1850 he was appointed Curator to the Museum of the Bristol Philosophical Society; in 1857 Assistant Palæontologist to the Geological Survey; and in 1881 he was transferred from the Museum of Practical Geology in Jermyn Street to the British Museum at South Kensington, where he acted as Assistant Keeper of Geology until the end of 1891. For more than 38 years until his death he was one of the Assistant Editors of the 'Geological Magazine,' and for 23 years up to that time he was Treasurer of the Palæontographical Society. He was elected a Fellow of the Royal Society in 1871. Well known as a geologist, chiefly from his investigation of rocks concealed beneath those which come to the surface, such as the underground Silurian ridge of Hertfordshire, and the Dover coalfields, his special study was palæontology, and he contributed lists of fossils, the species all carefully determined by himself, to 19 Geological Survey Memoirs, his other works and memoirs numbering 32. Amongst these may be specially mentioned his Catalogue of the 'Fossils of the British Islands,' of which only the first volume (Palæozoic) has been published, and his 'Stratigraphical Geology and Palæontology,' which though ostensibly merely his edition of Phillips' 'Manual of Geology,' is in reality a new work written by him. He was elected an Honorary Member of our Society in 1879. He died on 18th December, aged 84.

Mr. Glaisher is perhaps most widely known from his balloon ascents in the years 1862 to 1869, in one of which an altitude of seven miles was reached. These ascents were made by him for the purpose of ascertaining the temperature and humidity of the air at various altitudes, and he was essentially a meteorologist. Born at Rotherhithe on 7th April, 1809, at the age of 20 he was engaged upon the Trigonometrical Survey of Ireland, at 24 he was appointed Assistant at the Cambridge Observatory, at 26 Assistant at the Royal Observatory, Greenwich, and at 31 Superintendent of the Magnetic and Meteorological Department, from which he retired

in 1874. From 1847 to 1902 he contributed the "Remarks on the Weather" in the Registrar-General's 'Quarterly Return of Marriages, Births, and Deaths,' for which he organized a staff of observers whose instruments he tested, and he was for many years the recognized authority on the verification of meteorological instruments. He was elected a Fellow of the Royal Society in 1849; in 1850 he founded the British (now Royal) Meteorological Society, of which he was Secretary for 20 years; he was the first President of the Royal Microscopical Society, President of the Photographic Society for 22 years, Chairman of the British Association Committee on the Observation of Luminous Meteors for 20 years, member of the Council of the Aeronautical Society from 1866 until his death, and Chairman of the Palestine Exploration Fund from 1880. His numerous contributions to Meteorology are of the greatest value. He was one of the first Honorary Members of our Society, having been elected in 1875. He died on 7th February, 1903, in his 94th year.

The Most Hon. Robert Arthur Talbot Gascoigne-Cecil, K.G., M.A., D.C.L., F.R.S., 3rd Marquess of Salisbury, was a member of the Society for 25 years, having been elected in 1879. Although chiefly known as one of our most distinguished statesmen, he devoted much of his leisure time to scientific pursuits, carrying on experiments in chemistry and electricity in his well-equipped laboratory at Hatfield. He was twice a Vice-President of the Royal Society (1882–83 and 1893–94), Chancellor of the University of Oxford, and President of the British Association at the Oxford Meeting in 1894. He died on 22nd August, in his 74th year.

The Rev. John Wardale, late Fellow of Clare College, Cambridge, and for 22 years Rector of Datchworth, was elected in 1892. Resigning his rectorate in 1898, he left Datchworth for Cambridge, where he died on the 28th of November, in his 80th year.

Sir Charles Nicholson, Bart., M.D., D.C.L., LL.D., was a member of the Society for 20 years. Born in 1808, he commenced his career as a physician, taking his M.D. degree in 1833, and commencing to practice in Sydney in 1834. In 1843 he was returned to the first Australian Parliament, of which he was Speaker three times; he was the first President of the Queensland Legislative Council, and first Chancellor of the University of Sydney, which he was largely instrumental in founding. On retiring from public life he took up his residence at Totteridge, where he died on the 8th of November, in his 95th year.

Mr. T. Vaughan Roberts was elected a member of the Society in 1887. He was an observant naturalist, his special study being the Mammalia, on which he contributed two papers to our 'Transactions,' as well as several short notes or contributions to the discussions at our meetings. He served on the Council from 1893 to 1896.

The Council feels that the Society has been singularly unfortunate in the loss during the past year of such valued members who have been associated with the Society during so many years.

The census of the Society at the end of the years 1902 and 1903 was as follows :—

	1902.	1903.
Honorary Members	14	12
Corresponding Members	4	5
Life Members	44	42
Annual Subscribers	106	98
	168	157

The following papers or lectures have been read or delivered at Watford during the year :—

Feb. 24.—On some Fossiliferous Post-Tertiary Beds exposed at the Gas Works, Watford; by T. E. Lones, M.A., LL.D., B.Sc.
—— A Review of Hertfordshire Ornithology; by William Bickerton.
—— Notes on Birds observed in Hertfordshire during the year 1902; by William Bickerton.
March 24.—Anniversary Address—Sun-dials and their Mottoes; by the President, Lewis Evans, F.S.A., F.R.A.S.
April 21.—Notes on Lepidoptera observed in Hertfordshire in the year 1902; by Arthur E. Gibbs, F.L.S., F.R.H.S.
—— Some Hertfordshire Scale-insects; by John Hopkinson, F.L.S., F.R.M.S., Sec. Ray Soc., etc.
—— Report on Phenological Phenomena observed in Hertfordshire during the year 1902; by Edward Mawley, Sec. R.Met.Soc., F.R.H.S., Sec. Rose Soc.
—— Flowering Plants observed around Bushey in 1902; by Miss A. Hibbert-Ware.
Nov. 18.—Notes on the Habits of some of our Lepidopterous Insects; part 2, the Larger Moths; by Arthur Cottam, F.R.A.S.
Dec. 16.—A Journey amongst the Andes of Upper Peru; by Arthur W. Hill, M.A.

Mr. Hopkinson contributed to the 'Transactions' his usual annual reports on the Rainfall and on Meteorological Observations in Hertfordshire in 1902 without their being brought before a meeting of the Society, in accordance with Rule XVIII.

The following Field Meetings were held during the year :—

May 16.—Chalfont St. Giles.
—— 23.—Dunstable Downs.
June 27.—Kew Gardens.

The meeting on the 23rd of May was held in conjunction with the Geologists' Association.

The eleventh volume of the present series of the Society's 'Transactions' has been completed during the year by the issue of four parts, containing 128 pages and one plate. An important contribution to the topography of the county, the first two parts of a catalogue of Hertfordshire Maps, occupies a large portion of the volume (72 pages, 7 plates). The Meteorology and Phenology of the county are discussed in ten papers, eight being annual reports, one treating of the climate, and one of recent storms and floods; to the Geology three papers are devoted, one being a third list of works on the geology of Hertfordshire, covering the period 1884 to 1900, and two treating of the Hitchin palæolithic lake-bed, while a paper on the shrinkage of the River Lea combines meteorology

INCOME AND EXPENDITURE FOR THE YEAR 1903.

Dr.	£	*s.*	*d.*	Cr.	£	*s.*	*d.*
To Entrance Fees	1	10	0	By Balance, being amount overdrawn	6	12	8
,, Subscriptions for 1902	2	10	0	,, Printing 'Transactions'	42	19	2
,, ,, ,, 1903	43	10	0	,, Miscellaneous Printing	3	15	0
,, ,, ,, 1904	12	0	0	,, Expenses of Meetings	0	18	6
,, Dividends on £130 India 3 per cent. Stock	3	18	0	,, Library Expenses	3	8	3
,, Sale of 'Transactions' (£6 13*s.* 2*d.*), 'Flora of Herts' (£1), and 'Place-Names of Herts' (5*s.* 6*d.*)	7	18	8	,, Salary of Assistant	5	0	0
				,, Postages and Carriage of Parcels	10	2	5
				,, Fire Insurance Premium	0	12	6
,, Balance, being amount overdrawn	2	1	10				
	£73	8	6		£73	8	6

Amount invested in the purchase of £130 India 3 per cent. Stock . . . . £126 15*s.* 6*d.*

The above account includes Income and Expenditure to the date of audit. An outstanding liability of £1 is not included in the Expenditure.

Audited and found correct this 25th day of February, 1904, { JOHN HUNT. T. F. FURNIVAL, C.A.

with geology; and the contributions to the Zoology of the county are two annual reports on the Lepidoptera, a list of the Lepidoptera of Cheshunt, an account of a foreign beetle found at Watford, a list of the fish of the Upper Lea, and two annual reports on the birds observed. There are only two papers which do not give the results of local investigation—a Presidential Address on the progress of science and industry during the nineteenth century, and an account of the habits of the butterflies. The 'Proceedings' cover the period from the commencement of the session 1900–1 to the end of the year 1902. The volume is illustrated by eight plates and three woodcuts.

A few donations to the Library have been received and the usual number of exchanges. A list is appended. The Library has been open every Friday evening during the winter months, but the visits of members have been very few.

In conclusion, the Council desires to express the great indebtedness of the Society to the Watford Urban District Council for the use of the old Board Room, where the Library is kept, and for permitting the evening meetings to be held in the present Council Chamber at Upton House.

Additions to the Library in 1903.

Presented.

British Association for the Advancement of Science. Report for 1902 (Belfast). 8vo. London, 1903. . .	*The Association.*
Marriott, W. James Glaisher, F.R.S. (Quart. Journ. R. Met. Soc., 1903.)	*The Author.*
———. The Earliest Telegraphic Daily Meteorological Reports and Weather Maps. (Ibid.)	,,
Symons' Meteorological Magazine. Vol. xxxvii, January, 1903; vol. xxxviii, February–December, 1903 . .	*Dr. H. R. Mill.*

Received in Exchange.

Boston Society of Natural History. Proceedings. Vol. xxx, parts 3–7. 8vo. Boston (U.S.A.), 1902.

Cardiff Naturalists' Society. Transactions. Vol. xxxiv. 8vo. Cardiff, 1903.

Chester Society of Natural Science. Proceedings. No. 5.—List of Lepidoptera in Cheshire, Flint, Denbigh, Carnarvon, and Anglesey. 8vo. Chester, 1903.

Croydon Natural History and Scientific Society. Proceedings for 1902–3. 8vo. Croydon, 1903.

Edinburgh. Royal Physical Society. Proceedings. Session 1901–2. 8vo. Edinburgh, 1903.

Glasgow, Royal Physical Society of. Proceedings. Vol. xxxiv. 8vo. Glasgow, 1903.

London, Geological Society of. Abstracts of the Proceedings. Session 1902–3. 8vo. London, 1903.

———. Geologists' Association. Proceedings. Vol. xviii, parts 1–3. 8vo. London, 1903.

———. Quekett Microscopical Club. Journal. Ser. 2, vol. viii, Nos. 52, 53. 8vo. London, 1903.

London. Royal Meteorological Society. Quarterly Journal. Vol. xxix. 8vo. London, 1903.

———. ———. Meteorological Record. Vol. xxii, Nos. 86–88; vol. xxiii, No. 89. 8vo. London, 1903.

———. Royal Microscopical Society. Journal, 1903. 8vo. London.

Manchester Field Naturalists' and Archæologists' Society. Proceedings for 1902. 8vo. Manchester, 1903.

——— Geographical Society. Journal. Vol. xviii, parts 4–12; vol. xix, parts 1–12. 8vo. Manchester, 1903.

——— Geological and Mining Society. Transactions. Vol. xxvii, Contents; vol. xxviii, parts 3–9. 8vo. Manchester, 1903.

New York Academy of Sciences. Annals. Vol. xv, part 1. 8vo. Lancaster, Pa., 1903.

Norfolk and Norwich Naturalists' Society. Transactions. Vol. vii, part 4. 8vo. Norwich, 1903.

Northamptonshire Natural History Society and Field Club. Journal. Vol. xi, Nos. 89-92. 8vo. Northampton, 1903.

North Staffordshire Field Club. Transactions. Vol. xxvii. 8vo. Stafford, 1903.

Philadelphia Academy of Natural Sciences. Proceedings. Vol. liv, parts 2–3; vol. lv, part 1. 8vo. Philadelphia, 1903.

Rugby School Natural History Society. Annual Report for 1902. 8vo. Rugby, 1903.

Smithsonian Institution. Reprints from Annual Report for 1900: Life in the Ocean, by K. Brundt; Nature Pictures, by A. R. Dugmore; The Beaver, by A. R. Dugmore; Growth of Biology in the Nineteenth Century, by O. Hertwig; Restoration of Extinct Animals, by F. A. Lucas; Irrigation, by F. H. Newell; Forest Destruction, by G. Purchot; The National Zoo at Washington, by C. E. Seaton; Malaria, by G. M. Sternberg; Notable Advance in Colour Photography, by G M. Sternberg; Transmission of Yellow Fever by Mosquitoes, by G. M. Sternberg; Mutation Theory of Professor de Vries, by C. H. White; Breeding of the Arctic Fox, by H. Varigny. 8vo. Washington, 1902.

Somersetshire Archæological and Natural History Society. Proceedings. Ser. 2, vol. viii. 8vo. Taunton, 1903.

United States Geological Survey. 22nd Annual Report, for 1900–1. 8vo. Washington, 1901.

———. 23rd Annual Report, for 1901–2. 8vo. Washington, 1903.

———. Monographs. Vol. xlii. The Carboniferous Ammonoids of America, by J. P. Smith. 4to. Washington, 1903.

———. ———. Vol. xliii. The Mesabi Iron-bearing Districts of Minnesota, by C. K. Leith. 4to. Washington, 1903.

———. Bulletins. No. 195.—Structural Details in the Green Mountain Region and in Eastern New York, II, by T. N. Dale; No. 196.—Topographical Development of the Klamath Mountains, by J. S. Diller; No. 197.—Origin of certain Place Names in the United States, by H. Gannet; No. 198.—The Berea Grit Oil-sand in the Cadiz Quadrangle, Ohio, by W. T. Griswold; No. 199.—Geology and Water Resources of the Snake River Plains of Idaho, by I. C. Russell; No. 200.—Reconnaissance of the Borax Deposits of Death Valley and Mohave Desert, by M. R. Campbell; No. 201.—Results of Primary Triangulation, 1901–2; No. 202.—Tests for Gold and Silver in Shales from Western Kansas, by W. Lindgren; No. 203, Bibliography and Index of North American Geology, Palæontology, Petrology, and Mineralogy for the year 1901, by F. B. Weeks; No. 204.—Fossil Flora of the John Day Basin, Oregon, by F. H. Knowlton; No. 205.—The Mollusca of the Buda Limestone . . . , and Corals; by G. B. Shattuck and T. W. Vaughan; No. 206.—The Fauna of the Hamilton Formation of the Cayuga Lake Section in Central New York, by H. F. Cleland; No. 207.—The Action of Ammonium-Chloride upon Silicates, by F. W. Clarke and G. Steiger. 8vo. Washington, 1902.

U.S. Geol. Surv. Professional Papers. No. 1.—Preliminary Report on the Ketchikan Mining District, Alaska, by A. H. Brooks; No. 2.—A Reconnaissance of the North-Western Portion of Seward Peninsula, by A. J. Collier; No. 3.—The Geology and Petrography of Crater Lake, National Park, by J. S. Diller and H. B. Patton; No 4.—The Forests of Oregon, by H. Gannet; No. 5.—The Forests of Washington, by H. Gannet; No. 6.—Forest Conditions on the Cascade Range, Washington, by F. G. Plummer; No. 7.—Forest Conditions on Olympic Forest-Reserve, Washington, by A. T. Dodwell and T. F. Rixon; No. 8.—Forest Conditions in the North of Sierra Nevada, California, by J. B. Leibeng.

———. Water-Supply and Irrigation Papers. Nos. 65–79. 8vo. Washington, 1902-3.

Upsala, University of. Bulletin of the Geological Institution. Vol. v, part 2. 8vo. Upsala, 1902.

Wiltshire Archæological and Natural History Society. Magazine. Vol. xxxii, No. 97. 8vo. Devizes, N.D.

Purchased.

Botany, Journal of. Vol. xli. 8vo. London, 1903.

Michael, A. D. British Tyroglyphidæ. Vol. ii. (*Ray Society.*) 8vo. London, 1903.

Nature Notes. Vol. xiv. (*Selborne Society.*) 8vo. London, 1903.

Newstead, R. Coccidæ of the British Isles. Vol. ii. (*Ray Society.*) 8vo. London, 1903.

Novitates Zoologicæ. Vol. ix, pt. 4; vol. x, pts. 1, 2. 8vo. Tring, 1902–3.

Year-book of the Scientific and Learned Societies of Great Britain and Ireland. . . . 20th Annual Issue. 8vo. London, 1903.

Zoologist. Series 4, vol. vii. 8vo. London, 1903.

Visit to the Apartments of the Linnean Society, Burlington House, London, 26th March, 1904.

The members were received, at 3 o'clock, by their President, Mr. Daydon Jackson, General Secretary of the Linnean Society, who showed the personal relics of Linnæus in the possession of the Society, portraits of him, and his library and collections, including manuscripts, herbarium, insects, shells, and fish, and gave an account of their acquisition, and incidentally of the origin of the Society.*

Carolus Linnæus, eventually styled Carl von Linné, died in 1778, and his collections, including his library and manuscripts, were then purchased by his son, who, in 1781, spent three months in England, partly as the guest of Sir Joseph Banks, and died in 1783, having in five years added largely to his father's collections. The collections were then offered by his mother and sole executrix to Sir Joseph Banks for the sum of one thousand guineas. When the letter with this offer arrived (23rd December, 1783), a medical student, James Edward Smith, aged 24, was breakfasting with Banks, who told his visitor that he would decline the offer, and advised *him* to make the purchase. Smith wrote to Upsala the same day, and concluded the bargain in the following summer, the

* The Editor has added to Mr. Jackson's remarks some information from his "History of the Linnean Collections," in 'Proc. Linn. Soc.,' Session 1887–88.

cost including freight being £1,088. The ship conveying his purchase arrived in October, narrowly escaping detention by a vessel sent by the King of Sweden to intercept it. The collections then consisted of about 1,500 volumes of books, a considerable number of MSS., about 3,000 letters, 19,000 plants, 3,198 insects, 1,564 shells, 158 fishes on cards and some in spirit, a large number of corals, some other zoological specimens, and 2,424 minerals.

The possession by Smith of this extensive collection led to the foundation by him of the Linnean Society in 1788, and to his election, in his 30th year, as its first President.

In that year the young doctor removed from Chelsea to Great Marlborough Street, the Society first meeting in the Marlborough Coffee-house, near Dr. Smith's own house, in which shortly afterwards two rooms were taken, the meetings thus being held, soon after the foundation of the Society, under the roof which sheltered the Linnean collections.

In 1794 Dr. Smith removed to Hammersmith, taking with him his collections; and finally, in 1796, to his native city, Norwich, then selling the minerals but taking the rest of his possessions with him. He took his degree of M.D. in 1786, was knighted in 1814, and died in 1828.

It was anticipated that the founder of the Linnean Society would bequeath to it the Linnean collections, and in this belief he had been re-elected President for 40 years; it was therefore with great surprise that the Council heard from his executor that he was prepared to accept for them from the Society the sum of 5,000 guineas. This was subsequently reduced to 3,000 guineas, at which price the purchase was made in the following year, the Fellows of the Society subscribing about half the amount.

In 1796 the Society removed to Panton Square, Haymarket, and while here (in 1802) it obtained its charter from George III; in 1805 to Gerrard Street, Soho; and in 1820, on the death of Sir Joseph Banks, to Soho Square, occupying the rooms in his house which faced the square, its Librarian, Robert Brown the botanist, occupying the rest of the house. In 1857 the Government provided rooms in the old Burlington House, the Fellows of the Society subscribing £1,100 for their fitting-up and the expenses of removal, and in 1873 the present handsome and commodious quarters were erected specially for the Society by the Government.

The personal relics of the great Swedish naturalist shown to the members were an almanack and diary for the year 1735, in which was pointed out against the date of his birthday (13th May, Swedish style; 23rd May, new style) his own name reversed, written by him in large letters; a walking-stick with the *Linnæa borealis* on the upper part, believed to have been cut and carved by himself; and a carved rhinoceros-horn drinking-cup, being an exquisite example of Oriental art.

Medals struck in commemoration of Linnæus were shown, each with his head on the obverse: one in gold, struck in 1758 for

Count Tessin; one in silver, struck in 1746 for the same; and another in silver, struck in 1778 by command of Gustavus III.

Amongst the portraits of Linnæus in the possession of the Society two busts were pointed out, one in the Library, the other in the Council Room; the oil-painting by an unknown artist, over the President's chair in the Meeting Room (now replaced by a copy of the portrait by the elder Per Krafft); two other oil-paintings, one by Hallman, the other a copy by Pasch of the original by Roslin; and several engravings.

Amongst the manuscripts, the earliest, 'Hortus Uplandicus,' the date of which is believed to be 1730 (there are reworked copies of 1731), attracted attention as giving the first hint of the sexual system; another, 'Iter Lapponicum' (1734), from the curious admixture of Swedish and Latin, even in the same sentence.

The books shown were editions of the 'Systema Naturæ,' of the 'Genera Plantarum' and 'Species Plantarum,' and of the 'Flora Suecica,' all interleaved, with MS. additions.

Lastly were seen the Linnean herbarium, insects, shells, and fish, after which refreshments were kindly provided in the Secretary's Room, and a hearty vote of thanks was given by the members to their President for his interesting and instructive exposition of the treasures of the Linnean Society.

236TH ORDINARY MEETING, 29TH MARCH, 1904, AT WATFORD.

B. DAYDON JACKSON, F.L.S., President, in the Chair.

Mr. C. T. Gimingham, Harpenden, was proposed for membership of the Society.

A letter was read from Dr. H. R. Mill thanking the Society for his election as an Honorary Member.

The following papers were read:—

1. "Some Observations on the Exceptional Rainfall and on other Meteorological Phenomena in Hertfordshire in 1903." By John Hopkinson, F.L.S., F.G.S., V.P.R.Met.Soc., Assoc.Inst.C.E. (Printed as)

"Report on the Rainfall in Hertfordshire in the year 1903." (*Transactions*, Vol. XII, pp. 97–108.)

"Meteorological Observations taken in Hertfordshire in the year 1903." (*Transactions*, Vol. XII, pp. 117–124.)

Diagrams were exhibited in illustration of the paper.

2. "The Climbing and Twining Plants of the South Midlands." By James Saunders, A.L.S. (*Transactions*, Vol. XII, pp. 62–68.)

3. "Notes on Lepidoptera observed in Hertfordshire in the year 1903." By A. E. Gibbs, F.L.S., F.R.H.S. (*Transactions*, Vol. XII, pp. 109–116.)

Specimens were exhibited in illustration of the paper.

4. "Coleoptera new to the Hertfordshire Fauna." By A. E. Gibbs, F.L.S., F.R.H.S. (*Transactions*, Vol. XII, p. 156.)

A suggestion from a Committee of the Congress of Archæological Societies regarding a scheme for recording ancient defensive earthworks and fortified enclosures in the county was referred to by the President, who informed the meeting that the Council had decided to await the result of enquiries which would be made of the St. Albans and Hertfordshire Archæological Society before further considering the suggestion.

237TH ORDINARY MEETING, 19TH APRIL, 1904, AT WATFORD.

EDWARD MAWLEY, F.R. Met. Soc., F.R.H.S., Vice-President, in the Chair.

Mr. C. T. Gimingham was elected a Member of the Society.

The following papers were read:—

1. "Report on Phenological Phenomena observed in Hertfordshire during the year 1903." By Edward Mawley, F.R. Met. Soc., F.R.H.S. (*Transactions*, Vol. XII, pp. 89–96.)

2. "Notes on Birds observed in Hertfordshire during the year 1903." By William Bickerton. (*Transactions*, Vol. XII, pp. 125–134.)

3. "REPORT ON THE CONFERENCE OF DELEGATES TO THE BRITISH ASSOCIATION AT SOUTHPORT IN 1903." By JOHN HOPKINSON, F.L.S., F.G.S., V.P.R. Met. Soc., Sec. Ray Soc.

Having represented the Society at this Conference, it is my duty to give a brief report of such of the proceedings as may be of interest to our members.

The Conference met on the 10th and 15th of September, our Honorary Member, Mr. W. Whitaker, F.R.S., being Chairman, and our Corresponding Member, Mr. F. W. Rudler, Secretary.

FIRST MEETING.

The report of the Corresponding Societies Committee, *inter alia*, referred to a circular-letter addressed to the Corresponding Societies requesting them to appoint special Committees to deal with subjects of investigation common to the Societies and to Research Committees of the British Association.* The continued investigation of the subjects set forth in the Report for the previous year was recommended, with the addition of meteorological observations, the measurement of rain especially.

The President of the Association, Sir Norman Lockyer, K.C.B., F.R.S., addressed the Conference on the means to be adopted to form a Guild of Science, as a body which would use its influence in furthering the claims of science in Parliament and in County and other Councils throughout the country.

A lengthy discussion followed, in which the Delegates from the

* In response to this request our Council has appointed such a Committee, to consist of the Society's Recorders.

following Societies took part:—Cardiff and Nottingham Naturalists' Societies, Caradoc and Severn Valley Field Club, Croydon and Hertfordshire Natural History Societies, Southport and Yorkshire Philosophical Societies, and Woolhope Naturalists' Field Club. The following resolution, which the Chairman said had been passed by every Section that morning, was carried:—"That, as urged by the President in his Address, it is desirable that scientific workers and persons interested in science be so organized that they may exert permanent influence on public opinion, in order more effectually to carry out the third object of this Association, originally laid down by its founders, viz., 'To obtain a more general attention to the objects of science and the removal of any disadvantages of a public kind which impede its progress,' and that the Council be asked to take steps to promote such organization."

Mr. W. M. Rankin, B.Sc., read a paper on the Methods and Results of a Botanical Survey of Counties. Two papers dealing with the distribution of vegetation in the West Riding of Yorkshire had, he said, been published during the current year, constituting the first instalment of a Botanical Survey of England and Wales; surveys of areas in Westmorland and Somerset were in an advanced state; and botanical maps of several districts in Scotland were being issued.

The object of these surveys is to give a general idea of the vegetation of a county or other well-defined area, the dominant forms and groupings of plants being shown chiefly by means of maps. The local Societies were recommended to lay down the information on the 6-inch Ordnance Maps of their districts. How this can be done can only be ascertained by a study of some of the maps already published.

A short note on Ordnance Survey Maps by Mr. T. V. Holmes was then read by the Secretary. Attention was drawn to archæological information on the older 6-inch maps being omitted from new editions. The Chairman suggested that the Ordnance Survey should be written to on the subject, and he asked the Delegates to see whether there were any such omissions on the maps of their own districts.

Second Meeting.

A paper by Mr. William Cole, Hon. Sec. Essex Field Club, on Exploration and Registration Work for Local Societies, was read by the Secretary.

In the course of his introductory remarks the author suggested that local Societies would best aid the progress of science by the study of the natural history and archæology of their counties, by educational work of a propagandist character, and by assisting in the formation of museums and scientific libraries in their districts. To meet the expense of collecting and registering plants, animals, and fossils, and of archæological surveys, and of plotting-down the information obtained on maps, he proposed that the County Council of each county in which a scientific Society exists should be asked to allocate a small annual sum (say from £100 to £200), in

accordance with a scheme which he set out in detail, and for which reference should be made to the report of the proceedings of the Conference.*

He had left, he said, the primary difficulties until the last. Would our County Councils consider the subjects mentioned and the suggested method of treating them of educational value? If so, would they assist? And, finally, is such an allocation of educational funds legal? The work of collecting information respecting plants, animals, and fossils, directed by local committees, would certainly be of direct educational value to all taking part in it; and the reports, when issued, would be admirable object-lessons, serving to show how much of interest our own counties possess. And now that the importance of museums in education is so generally recognized, would not, he asked, the sets of specimens, accurately named, localized, and described, be of real use to students and investigators? Of the scientific importance of the results it was unnecessary to speak, but we must not forget that there is a strong feeling of local patriotism, which appeals to all, whether scientific or not.

Of the legal aspect of the question, he stated that he was not qualified to speak, but this might be submitted to the Board of Education.

The paper gave rise to a lengthy discussion. The Hon. Rollo Russell, representing the Haslemere Natural History Society, suggested that meteorology might be added to the subjects mentioned, and observations might be made of the diseases of plants, and of the relations of plants to meteorology. There was an enormous field for investigation in meteorology, and if it were added it would help, he thought, towards getting grants from County and Town Councils. Experiments might also be made on plant-life in relation to soils, weather, and various other conditions.

Mr. W. Ackroyd said that the work of the Halifax Scientific Society, which he represented, had a direct bearing on this subject, especially as to its legal aspect. They had two museums, one given up to anthropological subjects, the other mainly to geology and mineralogy, and for these museums honorary curators were appointed by the local scientific Societies. When funds are required they state the amount wanted, and the purpose for which it is required, and a representative of these curators makes a recommendation to a Committee of the Council, and so far they have been able to get all the money they required, the grants made from time to time having varied from £100 to £300. He thought that what they did in Halifax the Delegates might be able to do in other places.

Your Delegate gave an account of the foundation and management of the Hertfordshire County Museum, and of the aid given to it by the County Council. As to giving the information acquired by investigations of various kinds on maps (urged by several

* Rep. Brit. Assoc. for 1903, pp. 484, 485.

speakers), he said that they were no doubt very useful, as they enabled things to be seen at a glance, but he presumed that these investigations were not of much use unless they were published, and maps were much more expensive to publish than tabular or other statements. It was with the greatest difficulty that his Society was kept up, for want of funds.

Mr. Cole's suggestions were eventually referred to the Corresponding Societies Committee.

The Secretary read a letter from Mr. Herbert Stone, F.L.S., President of the Birmingham Natural History and Philosophical Society, and its Delegate to this Conference, as to railway fares for members of Scientific Societies, giving particulars of a petition to the Railway Companies from 22 Societies with a membership of 1,700, for reduced fares for their members when travelling singly. This would place them on the same footing as members of angling clubs, and it was inferred that the increase in membership of such clubs, since this reduction was allowed, of from about 300 to many thousands, was largely due to it.

The discussion was commenced by your Delegate, who stated the conditions under which the members of one Society, the Yorkshire Naturalists' Union, obtain return tickets at a fare and a quarter when travelling singly in Yorkshire to meetings or excursions of their Union. A signed card of membership and a copy of the excursion-circular have to be produced.

Dr. W. R. Scott said that members of Irish Societies get this privilege from Railway Companies in Ireland by applying to the Secretary of their Society for a form which has to be presented to the Company, and the Secretary then gets the ticket at the reduced rate.

Mr. G. W. Lamplugh, F.G.S., said that in Ireland the privilege was not confined to attendance at meetings or excursions, for on two occasions the Secretary of his Society obtained a warrant authorizing him, when travelling to see excavations, to get a ticket for field-club business at a single fare for the double journey; and Captain Dubois Phillips, R.N., said that golf tickets were made out in a similar way, a ticket being obtained from the Secretary and signed by the member.

Research work of several sections of the Association was then considered.

In connection with Section A (*Mathematical and Physical Science*), the Secretary of the Conference read the following letter from Mr. W. Marriott, Assistant Secretary of the Royal Meteorological Society:—

"I should be glad if you would bring to the notice of the Conference of Delegates of Corresponding Societies the fact that the Council of the Royal Meteorological Society has undertaken to furnish for the 'International Catalogue of Scientific Literature' the titles of papers bearing on meteorology which are published in the British Isles.

"As this work cannot be complete unless the Society is in possession of all the publications containing meteorological papers, the Council would be glad if the Delegates of Corresponding Societies would assist in this matter, by requesting all

the local scientific Societies printing papers or reports bearing on meteorological subjects to forward a copy of the same to the Royal Meteorological Society, 70, Victoria Street, Westminster, S.W. (if they do not already do so), to insure the titles being included in the 'International Catalogue.'"

I may add to this that the Linnean Society is collecting for this 'Catalogue' the titles of all papers with any botanical information which are published in Britain, and that copies of all such papers should be sent to the Society at Burlington House, W.; and also that the Zoological Society is similarly collecting titles of zoological papers, copies of which should be sent to that Society at 3, Hanover Square, W.

Section C (*Geology*) was represented by Mr. Lamplugh, who referred to the work of several Committees of that Section. Of these our Society can aid, and has aided, the Committee for the registration of geological photographs and that for the registration of erratic blocks.

Under Section D (*Zoology*) the Rev. T. R. R. Stebbing said that he was a Committee appointed to investigate the underground fauna of Great Britain, and he asked for well-shrimps and other fresh-water crustaceans living in wells to be sent to him, in spirit or formalin, addressed to Ephraim Lodge, Tunbridge Wells.

Under Section E (*Geography*) Mr. E. Heawood, M.A., contributed the following list of subjects for research in connection with local geography:—

Correlation of physical surface-features with geological structure.

Evolution of river-systems.

Relation of physical factors to distribution of population.

Distribution of vegetation, and the relation of plant-formations to their environment.

The distribution of zoological groups in connection with environment.

While the study of representative types of Insecta and Mollusca from this point of view was specially recommended by biologists, it might, he said, be made equally interesting from the point of view of geography.

Professor Weiss, D.Sc., F.L.S., on behalf of Section K (*Botany*), stated that the Committee of this Section was being greatly aided by local Societies. He asked for help in two new researches, for Mr. Alfred Friar on the British species of *Potamogeton*, and for Miss Ethel Sargant on the British orchids.

Miss Sargant explained that she wished for information on plants with underground growth, especially as to whether their leaves last longer than their flowers, and whether the plants are reproduced to any extent by seed.

Some other subjects were brought before the Conference, and on the whole the proceedings were perhaps of more varied and more practical interest to the Corresponding Societies than on any previous occasion.

Field Meeting, 16th April, 1904.

BOURNE END AND THE VALLEY OF THE BOURNE.

After an interval of quiescence of fourteen years the intermittent stream known as the Hertfordshire Bourne last flowed in 1897, and it was visited by the Society on the 24th of April, 1898.* On that occasion its flow was anticipated, and the present writer visited the valley twice in March before it commenced.

In the Autumn of 1903, after nearly seven years without excessive rainfall, it was again apparent that a sufficient quantity of rain had fallen to cause the Bourne to flow, and it was surmised that it would commence to do so much earlier than usual. On the 31st of October the rainfall at Weetwood, Watford, for the ten months of the year then elapsed, amounted to 35½ inches, of which 7½ inches fell in October. Although there is no record of an earlier commencement of flow in the Winter than the beginning of January, it was thought advisable to look out for it on this occasion early in November, and the valley was visited on the 7th of that month. There was then no sign that the stream was soon about to flow, not even by any considerable rise of the water in wells, so far as could be ascertained by enquiries, and the valley was not again visited for three weeks. The stream was then found to be running in places, not continuously, and it was ascertained that the flow commenced on the 15th of November.

From that time its volume gradually increased, but it was not until the 1st of January that there was an unbroken stream from its source, then some distance above Harratt's End Lane, to its discharge into the Bulbourne below Bourne End, and it attained its greatest volume about the end of February. It was therefore arranged to hold a field meeting here earlier in the year than they usually commence, so that the stream might be seen before any great diminution took place in its volume.

A large party, chiefly consisting of members who cycled from Watford, assembled at Bourne End at 3 o'clock, and proceeded up the valley under the direction of Mr. Hopkinson, taking the route followed on previous visits.

Just above the point where the stream crosses the lane up the valley, this lane was found to be under water and impassable, and for a short distance the fields had to be taken. Numerous gaps had been made in the hedge, as the water extended more and more along the lane, but now it had been shrinking for some time, and its depth had much decreased since February. On arriving at Harratt's End Lane it was found that, owing to the culvert under the lane having been choked, damage had been done to the road-surface by the overflow of the water impounded above it by the embankment made to take the road across the valley. That this would occur was foreseen by the writer, who had advised the clearance of this

* See 'Trans. Herts Nat. Hist. Soc.,' Vol. IX, p. lxv (1898).

culvert early in the year. It had now been cleared, and the fine sheet of water which had existed here, forming a conspicuous feature in the landscape, had disappeared, leaving only a tiny stream flowing through a muddy swamp, not even in sufficient volume to reach the culvert, for it disappeared underground and reappeared below the lane.

In 1897 the Bourne was traced to its source, but this time no farther than this lane. In returning, the gravel-pit much lower down the valley, which when the Bourne flows is converted into a pond, was found to be nearly full of water, but although a considerable stream was flowing into it, not a drop of water appeared to be flowing out of it, another instance of underground flow only, for the stream was again seen a few feet below the pond.

On arriving at Bourne End tea was provided at the White Horse Inn, and the Director gave an explanation of the phenomena which had been witnessed, and stated the dates on which the Bourne had been known to flow. As this information is already in our 'Transactions,' it need not be repeated. The mean rainfall in Hertfordshire for the year 1903 was stated to have been 37·83 ins., of which 33·72 ins. fell up to the end of October; and in the Colne district 38·86 ins., and 34·52 ins. to the end of October. In the valley of the Bulbourne the fall was stated to have been still greater, the average at five stations, all above Bourne End, being 40·16 ins. in the year, and 35·32 ins. in the first ten months. A letter was then read from Mr. T. C. Myddelton, in which he gave the average discharge of the Chadwell Spring in cubic feet per minute for certain weeks as follows:—Average for the week ended 3rd January, 1903, *nil*; 4th April, 243; 13th June, 17; 7th November, 424; 26th December, 405; 9th April, 1904, 382; the decrease, it was stated, having been daily and gradually since the 7th of November, 1903. Thus it appeared that the Bourne broke out about the time of the maximum discharge of the Chadwell Spring, but that while that spring gradually decreased in volume from November to April, the Bourne increased for three months and a half, from its rise in the middle of November to the end of February.

It may be well to append the sources of information on the flowing of the Bourne which may be found in our 'Transactions.'

1877. Evans, J.—"The Hertfordshire Bourne." Trans. Watford Nat. Hist. Soc., Vol. I, p. 137.
1882. Hopkinson, J.—"The Bourne Valley, Boxmoor." Trans. Herts Nat. Hist. Soc., Vol. I, p. lviii.
1883. Littleboy, J. E.—"The River Bourne." Ib., Vol. II, p. 237.
1884. Hopkinson, J.—"Berkhamsted and the Valley of the Bourne." Ib., Vol. II, p. lv.
1898. ——— "The Valley of the Bourne, Boxmoor." Ib., Vol. IX, p. lxv.
1899. ——— "The Chadwell Spring and the Hertfordshire Bourne." Ib., Vol. X, p. 69.

The following papers, which, though treating of the Croydon Bourne, refer incidentally to our Bourne, may also be consulted:—

1884. FRENCH, H. H.—"On Bournes." (Sutton Scientific Society.) 8vo. Sutton, Surrey.
1904. LATHAM, B.—"Croydon Bourne Flows." (Croydon Natural History Society.) 8vo. London.

FIELD MEETING, 28TH MAY, 1904.

JORDANS AND THE CHALFONTS.

As the programme arranged for last year's visit to this pretty part of Buckinghamshire could only be partly carried out owing to the rain, the same route was again chosen, and this time it was taken in its entirety, in beautiful weather, Mr. Hopkinson being the Director as on the former occasion.

The party consisted of cyclists only, and was not quite so numerous as in 1903. As the Church and Milton's cottage at Chalfont St. Giles had then been seen, this village was passed through without a halt, and the old Quakers' Meeting House at Jordans was the only place of interest visited. It is at the point where the roads from Chalfont St. Giles and Chalfont St. Peter to Beaconsfield join, near the foot of a rather steep hill from the former place and of a very steep hill from the latter, Stone Dean being at the bottom of the valley, which is beautifully wooded, and Wilton Park rising on the opposite hill.

The ground on which the Meeting House stands was conveyed, in 1671, from William Russell to Thomas Ellwood and others for a burial-place for the Society of Friends. The first mention of any building there is in 1688, when a meeting-house is spoken of. It was probably built, and the lime-trees by which it is now much shut in were probably planted, in that or the previous year. Here William Penn, the founder of Pennsylvania, worshipped, more than once being imprisoned for his faithfulness to his religious views, and here he was buried, with his family and many of his relations. Hertfordshire, as well as Buckinghamshire, can claim some interest in connection with his life in England, for he lived for some years (1671–1677) at Basing House, Rickmansworth, marrying during his residence there (in 1672) at Chorley Wood.

William Penn was born in London on the 14th of October, 1644. He was the son of Admiral Sir William Penn, the conqueror of Jamaica, to whom, at his death in 1670, the Government owed £16,000. In discharge of this debt a province in North America, about as large as England, was granted to the son in 1681, and he named it, on account of its sylvan character, Sylvania, but, in honour of Penn's father, the name was changed by Charles II to Pennsylvania. Penn first went out there in 1682 with about one hundred Friends, his voyage in the "Welcome" occupying nearly two months (31st August to 28th October). He proved to be an able lawgiver, and most justly administered the province. He returned to England in 1684, his wife died at Hoddesdon in 1694, he married again in 1696, returned to Pennsylvania with his new wife in 1699, and again to England in 1701. He died in 1718,

and was interred at Jordans on the 5th of August. He not only suffered imprisonment for his religious views, but was also deprived by William III of his Government of Pennsylvania. This was restored to him before his second voyage there. Although he returned to England each time on behalf of his province, the reason he was so much in this country after the grant to him of "Pensilvania" (so in the Charter) seems to have been that he considered the interests of the Society of Friends, who were suffering much fanatical persecution, demanded his presence here more than it was required in his American province, where all were free to worship in accordance with their religious belief. He wrote many works, chiefly religious, of which the most celebrated is 'No Cross, no Crown.' This was written in the Tower during his first imprisonment for heresy, and was printed in 1669. It has frequently been reprinted and has been translated into several foreign languages.

After strolling for a while in the woods, and then having tea in the Meeting House, where the above-mentioned incidents in the life of William Penn were given (rather less fully) by the Director, the party returned to Watford and elsewhere by way of Chalfont St. Peter, Maple Cross, and Rickmansworth.

Field Meeting, 4th June, 1904.

TRING AND THE CHILTERN HILLS.

About once in every three years since 1894 the Zoological Museum established at Tring in 1889 by the Honourable Walter L. Rothschild has been visited by the Society by his permission on a Saturday afternoon, a day on which it is not open to the public. On previous occasions the members have been conducted over the Museum by the Director, Mr. E. Hartert; this time Dr. K. Jordan acted as guide. The meeting was under the direction of Mr. H. Kidner, and the party numbered about twenty.

The general features of the Museum and the most interesting specimens exhibited have been mentioned or briefly described in the reports of previous visits. A few animals only which have not been noticed before will now be referred to.

Amongst the Mammalia, of which there are representatives from all parts of the world, two Monotremes (Ornithodelphia) attracted special attention. One, the spiny ant-eater (*Echidna aculeata*), is a terrestrial species from New Guinea, with beak-like jaws, a long and slender tongue, a body covered with hairs and spines, feet with strong digging claws, and a very short, almost obsolete tail. The other, the duck-billed platypus (*Ornithorhynchus anatinus*), is an aquatic species from Australia, with a flat, duck-like snout, a short tongue, mole-like fur, webbed feet, and a broad and flat tail of moderate length. The two creatures thus differ greatly in appearance, as they also do in habits, yet from their internal organization they are placed in the same order, Monotremata,

a very small one, containing these genera only, and but one or two other species.

Next to the Monotremes come the Marsupials (Didelphia), a very much larger order, the best known examples of which are the kangaroos and opossums (*Macropus*, *Didelphis*, etc.). These genera, with their allies, are well represented by specimens of several species. The Tasmanian wolf (*Thylacinus cynocephalus*), Chinese flying squirrel (*Pteromys alborufus*), ashy koala (*Phascolarctos cinereus*), and Tasmanian wombat (*Phascolomys ursinus*), with other less-known creatures, belong to this interesting order, specimens of which may here be studied with advantage, as the skeletons of many of them are placed by the side of the stuffed animals.

Simulating the Marsupialia to a great extent in appearance, but belonging to a very different order, the Rodentia, the most extensive and complex order of the Mammalia, is the family of the Muridæ, all the members of which have the hind legs much longer than the fore, chiefly owing to the great development of the tarsus. The most interesting example of this family observed was the *Conilurus constructor* of New South Wales, which was originally brought to this country from Sydney under the name of the "native rabbit." Its fur is long, soft, and downy, and its tail is slender and as long as the head and body together. The generic name signifies a small rabbit with a long tail, and the specific indicates its constructive abilities. It builds a very strong dwelling of dry sticks and brushwood, sufficient to make two or three good cart-loads. In this it makes its nest and rests secure from the attacks of the dingo, or so-called "native dog," which, however, most probably is not aboriginal.

All the other orders of the Mammalia are well represented, especially the highest, the Primates, which comprise the monkeys and man; so also are the other classes of the Vertebrata, the fishes, amphibians, reptiles, and birds, to which well-known divisions should be added the Leptocardii, to bring in the curious *Amphioxus*, and possibly also the Tunicata, which, although closely resembling the Lamellibranchiata in structure, are now believed by many zoologists to be degenerate Vertebrata, but examples of these peculiar marine animals were not seen.

Although the Vertebrata form the most prominent feature of the collections open to the public, nearly all the classes of the Invertebrata are also represented, and many profusely: there are innumerable moths and butterflies (Lepidoptera), these being under the special care of Dr. Jordan; and it may be mentioned here that not only is the Hon. Walter Rothschild a most distinguished zoologist, but his brother, the Hon. N. Charles Rothschild, is our greatest authority on the Pulicidæ, a well-known but not much admired family of the Arthropoda which leap with their hind legs and suck with their mandibles.

Before leaving the Museum a vote of thanks was accorded to Mr. Rothschild and to his curator Dr. Jordan, and the party then repaired to the "Rose and Crown" hotel for tea.

After tea some of the members strolled into Tring Park, where emus, rheas, and kangaroos were seen in their living state and appeared to be less timid than the deer. Others went on through Tring, past the "Britannia," across the allotments, and by field-path and through woods to the summit of Coombe Hill, one of the highest spurs of the Chiltern Hills. It is upwards of 800 feet in height, and is one of four such hills in the neighbourhood, with much the largest surface above the 800 ft. contour-line, the others being Coombe Hill near Wendover, on which a monument has been erected to the men of Bucks who fell in the South African War; part of the hill between Ringshall and Ivinghoe Beacon Hill; and the highest point between Kensworth and the Dunstable Downs, where the road crosses the boundary between the counties of Beds and Herts. The fact that there are two hills of the same name within a few miles of each other is doubtless due to the combes or dry valleys in the Chalk which descend from them, one of which was well seen and gave rise to a discussion on their origin. The splendid view from the Coombe Hill of Tring over the Vale of Aylesbury was felt to be well worth the climb, and from it the geological features of the landscape were pointed out by Mr. Hopkinson and Mr. Kidner.

Field Meeting, 18th June, 1904.

ST. ALBANS.

A party of about forty met at the Hertfordshire County Museum, and proceeded, under the direction of Mr. A. E. Gibbs, to the orchid-houses of Messrs. F. Sander & Co., where they were received by the late Mr. H. G. Moon, who conducted them over the premises.

Several new and rare plants were shown, and Mr. Moon explained the results attained by cross-fertilization of several species. A house containing young seedling orchids was seen, and orchids in flower from a cross made seven years ago were examined, this being about the time, it was explained, before any judgment could be formed of the result of the crossing.

A vote of thanks, proposed by Mr. Neele, was accorded to Messrs. Sander & Co. and to Mr Moon, and the party then returned to the County Museum, where tea was kindly provided by Mr. and Mrs. A. E. Gibbs, to whom, also, a vote of thanks, proposed by Mr. Hopkinson, was accorded, after which the contents of the Museum were inspected.

238th Ordinary Meeting, 2nd November, 1904, at Watford.

John Hopkinson, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C.E., in the Chair.

The Rev. A. H. Cooke, M.A., F.Z.S., Aldenham School, Elstree; Captain J. B. Gilliatt, D.S.O., Chorleywood Cedars, Rickmansworth;

Mr. V. P. Kitchin, B.A., The Priory, Watford; Mr. J. Pierpoint Morgan, jun., Aldenham Abbey, Watford; and the Rev. C. M. O. Parkinson, M.A., St. Mary's Vicarage, Rickmansworth, were proposed for membership of the Society.

The following paper was read:—

"The Gravels of Hertfordshire." By A. E. Salter, D.Sc., F.G.S. (*Transactions*, Vol. XII, pp. 137–144.)

The paper was illustrated by maps and specimens.

239TH ORDINARY MEETING, 14TH DECEMBER, 1904, AT WATFORD.

JOHN HOPKINSON, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C.E., in the Chair.

The Rev. A. H. Cooke, M.A., F.Z.S., Captain J. B. Gilliatt, D.S.O., Mr. V. P. Kitchin, B.A., Mr. J. Pierpoint Morgan, jun., and the Rev. C. M. O. Parkinson, M.A., were elected Members of the Society.

Mr. George William Lamplugh, F.G.S., Geological Survey of England, 13, Beaconsfield Road, St. Albans, and Mrs. Arthur King Smith, Rutherglen, Clarendon Road, Watford, were nominated for membership.

The following lecture was delivered:—

"Deep-sea Soundings." By Arthur Earland, Secretary of the Quekett Microscopical Club.

The lecture, a popular description of the Foraminifera and of their work as World-builders, was illustrated by lantern-slides and specimens.

240TH ORDINARY MEETING, 25TH JANUARY, 1905, AT WATFORD.

JOHN HOPKINSON, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C.E., in the Chair.

Mr. G. W. Lamplugh, F.G.S., and Mrs. Arthur King Smith were elected Members of the Society.

Mr. Clement G. L. Ellis, 11, St. Peter's Street, St. Albans, was proposed for membership.

The following lecture was delivered:—

"The Upper Regions of the Atmosphere." By William Marriott, F.R. Met. Soc., Assistant Secretary of the Royal Meteorological Society.

The lecture was illustrated by a large number of lantern-slides.

241st Ordinary Meeting, 22nd February, 1905, at Watford.

B. Daydon Jackson, F.L.S., President, in the Chair.

Mr. Clement G. L. Ellis was elected a Member of the Society.

Mr. Thomas R. Burton, Cosgrove, 101, Kingsfield Road, Watford; Miss Campbell, Marlborough Road, Watford; Mr. H. Langford Lewis, Valency House, Eastbury, Watford; and Miss Seed, Marlborough Road, Watford, were nominated for membership.

The following lecture was delivered:—

"Hertfordshire Maps and Topographical Works." By Herbert George Fordham, Chairman of the Cambridgeshire County Council.

The lecture was introductory to the concluding portion (Part III, 1794–1900) of Mr. Fordham's "Hertfordshire Maps: a Descriptive Catalogue of the Maps of the County, 1579–1900." (*Transactions*, Vol. XII, pp. 169–208.)

An interesting collection of Hertfordshire maps and numerous old topographical works containing maps of the county were exhibited by the author.

242nd Ordinary Meeting, 8th March, 1905, at Watford.

B. Daydon Jackson, F.L.S., President, in the Chair.

Mr. Thomas R. Burton, Miss Campbell, Mr. H. Langford Lewis, and Miss Seed were elected Members of the Society.

Mr. Arthur Wheelwright, 18, Grosvenor Road, Watford, was proposed for membership.

30th Anniversary Meeting, 8th March, 1905.
(At Watford.)

B. Daydon Jackson, F.L.S., President, in the Chair.

The Report of the Council for the year 1904, and the Treasurer's Account of Income and Expenditure, were read and adopted.

The President delivered an Address on "The History of Botanic Illustration." (*Transactions*, Vol. XII, pp. 145–156.)

The Address was illustrated by a large number of lantern slides and numerous old botanical works, from the figures in which many of the slides had been photographed.

The following gentlemen were duly elected as the Officers and Council for the ensuing year:—

President.—John Morison, M.D., D.P.H., M.R.C.S., F.G.S.

Vice-Presidents.—Sir John Evans, K.C.B., D.C.L., LL.D., Sc.D., F.R.S., V.P.S.A., etc.; Lewis Evans, F.S.A., F.R.A.S.; B. Daydon Jackson, F.L.S., Gen. Sec. Linn. Soc.; Edward Mawley, F.R. Met. Soc., F.R.H.S., V.M.H., Sec. Rose Soc.

Treasurer.—John Weall.

Honorary Secretaries.—A. E. Gibbs, F.L.S., F.R.H.S.; Arthur Sutton, Assoc. R.S.M.

Editor.—John Hopkinson, F.L.S., F.G.S., F.R.M.S., V.P.R. Met. Soc., Assoc. Inst. C. E., Sec. Ray Soc.

Librarian.—Daniel Hill, F.R.H.S.

Other Members.—John Attfield, M.A., Ph.D., F.R.S., F.C.S., F.I.C.; Philip J. Barraud, F.E.S.; W. Bickerton; E. T. Burr, F.R.H.S.; Alfred E. Cox, M.R.C.S., L.R.C.P.; Arthur E. Ekins, F.C.S., F.I.C.; Henry Kidner, F.G.S.; T. E. Lones, M.A., LL.D., B.Sc.; James K. Riggall; W. Lepard Smith; the Right Hon. the Earl of Verulam; Henry J. Worssam.

The thanks of the Society were accorded to Mr. B. Daydon Jackson retiring from the office of President; to the Right Honourable the Earl of Verulam retiring from the office of Vice-President; and to Mr. W. R. Carter, Mr. G. P. Neele, and Mr. W. Whitaker, F.R.S., retiring from the Council.

Report of the Council for the Year 1904.

During this, the 30th year of the Society's existence, although one Honorary Member and nine Ordinary Members have been elected, the Council regrets to report that a rather greater number of Ordinary Members has been lost to the Society by death or resignation, and that the attendance at the Ordinary Meetings has fallen off. The diminished attendance may be attributed, in part, to the change of the evening for meetings from Tuesday to Wednesday in order to avoid clashing with a series of University Extension Lectures held in Watford. The change has proved unsatisfactory, owing to the large number of competing meetings and entertainments which fall on Wednesday, the early-closing day at Watford. It is to be feared, however, that there is a growing lack of interest in the work of the Society, and the Council appeals to the members generally for more active support, and for their co-operation in making known the advantages of the Society to residents in the County, and more especially to new residents who are interested in Natural Science.

The Society has elected as an Honorary Member, Hugh Robert Mill, LL.D., D.Sc, F.R.S.E., Sec. R. Met. Soc., whose valuable work in connection with Meteorological Science, and especially rainfall, is so well known.

The census of the Society at the end of the years 1903 and 1904 was as follows:—

	1903.	1904.
Honorary Members	12	13
Corresponding Members	5	5
Life Members	42	44
Annual Subscribers	98	93
	157	155

Five Ordinary Meetings were held at Watford during the year, at which the following papers and lectures were delivered, in addition to the Annual Address of the President, Mr. B. Daydon Jackson, Sec. Linn. Soc., on "Hertfordshire Naturalists and their Work," delivered at the Anniversary Meeting on March 1st:—

Feb. 3.—Cheese Mites and some other Mites; by John Hopkinson, F.L.S., F.G.S., F.R.M.S.
—— On the Occurrence of *Sirex noctilio* and *Sirex gigas* in Hertfordshire; by A. E. Gibbs, F.L.S., F.R.H.S.
—— Notes on some Hertfordshire Mammalia; by A. E. Gibbs, F.L.S., etc.
—— Report on the Conference of Delegates to the British Association at Belfast in 1902; by John Hopkinson, F.L.S., etc.
March 29.—Some Observations on the exceptional Rainfall and on other Meteorological Phenomena in Hertfordshire in 1903; by John Hopkinson, Vice-Pres. R. Met. Soc., Assoc. Inst. C.E.
—— The Climbing and Twining Plants of the South Midlands; by James Saunders, A.L.S.
—— Notes on Lepidoptera observed in Hertfordshire in the year 1903; by A. E. Gibbs, F.L.S., F.R.H.S.
—— Coleoptera new to the Hertfordshire Fauna; by A. E. Gibbs, F.L.S., etc.
April 19.—Report on Phenological Phenomena observed in Hertfordshire during the year 1903; by Edward Mawley, F.R. Met. Soc, F.R.H.S.
—— Notes on Birds observed in Hertfordshire during the year 1903; by William Bickerton.
—— Report on the Conference of Delegates to the British Association at Southport in 1903; by John Hopkinson, F.L.S., F.G.S., Vice-Pres. R. Met. Soc.
Nov. 2.—The Gravels of Hertfordshire; by A. E. Salter, D.Sc., F.G.S.
Dec. 14.—Deep-Sea Soundings; by Arthur Earland, Sec. Quekett Micros. Club.

The following Field Meetings, which were well attended, were held during the year:—

April 16.—Bourne End.
May 28.—Jordans and the Chalfonts.
June 4.—Tring and the Chiltern Hills.
,, 18.—St. Albans.

An interesting visit was also paid to the Linnean Society's Apartments at Burlington House on March 29, when the President, Mr. B. Daydon Jackson, Sec. Linn. Soc., kindly showed the Portraits, Personal Relics, Collections, and Library of Linnæus in the possession of that Society.

Three parts of the twelfth volume of the present series of the Society's 'Transactions' have been published during the year, containing 136 pages, with 22 illustrations in the text.

The usual exchanges of publications have been made, several publications of learned Societies having been added to the Library. The existing arrangements for storing the Library in the old Board Room of the Watford Urban District Council continue, however, to be very inconvenient. The books are practically inaccessible, and very little use is made of them by Members.

INCOME AND EXPENDITURE FOR THE YEAR 1904.

Dr.	£	s.	d.	Cr.	£	s.	d.
To Entrance Fees	5	0	0	By Balance, being amount overdrawn	2	1	10
,, Life Compositions	10	0	0	,, Printing 'Transactions'	39	13	3
,, Subscriptions for 1903	1	0	0	,, Miscellaneous Printing	10	3	11
,, ,, ,, 1904	35	0	0	,, Expenses of Meetings	4	3	6
,, ,, ,, 1905	10	10	0	,, Library Expenses	3	1	8
,, Sale of 'Transactions' (7*s.* 6*d.*), 'Flora of Herts' (9*s.* 6*d.*), 'Place-Names of Herts' (£2 12*s.* 6*d.*)	3	9	6	,, Salary of Assistant	5	0	0
				,, Postages and Carriage of Parcels	10	7	2
				,, Fire Insurance Premium	0	12	6
,, Dividends on £130 India 3 per cent. Stock	3	18	0	,, East Herts Archæological Society (for 'Place-Names of Herts')	3	2	6
,, Balance, being amount overdrawn	10	13	2	,, Stationery	1	0	2
				,, Cheque Book (stamps)	0	4	2
	£79	10	8		£79	10	8

Amount invested in the purchase of £130 India 3 per cent. Stock . . . . £126 15*s.* 6*d.*

Audited and found correct this 7th day of April, 1905, { ARTHUR COTTAM. JAMES K. RIGGALL.

The Council will therefore be compelled to consider the question of finding some more suitable accommodation for them.

The Balance Sheet shows an unsatisfactory condition of the funds of the Society, and it is hoped that there will soon be an accession of subscribers, or the work of the Society will be seriously hampered.

The best thanks of the Society are due to the Watford Urban District Council for generously allowing the free use of the Council Chamber for the evening meetings, and of the old Board Room for the Library.

Additions to the Library in 1904.

Presented.

Baxendell, J. The Fernley Observatory, Southport. Report for the year 1901. 4to. Southport, 1902 . . .	*The Author.*
British Association for the Advancement of Science. Report for 1903 (Southport). 8vo. London, 1904 .	*The Association.*
British Museum. Handbook of Instructions to Collectors. 8vo. London, 1904	*The Trustees.*
———. Guide to Coral Gallery. 8vo. London, 1904 .	,,
———. Economic Zoology. 2nd Report. 8vo. London, 1904	*Sir John Evans.*
Geological Survey of England and Wales. Summary of Progress for the year 1903. 8vo. London, 1904 .	*The Director.*
Symons' Meteorological Magazine. Vol. xxxviii, January, 1904; vol. xxxix, February–December, 1904 . .	*Dr. H. R. Mill.*
Williamson, W. C. Reminiscences of a Yorkshire Naturalist. 8vo. London, 1896	*Exors. of late Dr. Williamson.*

Received in Exchange.

American Museum of Natural History. Report for the year 1900, and Bulletins Nos. 32–48. 8vo. Albany, 1902. Report for the year 1901, and Bulletins Nos. 49–58, 60–62, 64–67. 8vo. Albany, 1903.

Bath Natural History and Antiquarian Field Club. Proceedings. Vol. x, part 3. 8vo. Bath, 1904.

Belfast Naturalists' Field Club. Proceedings. Ser. 2, vol. v, part 2. 8vo. Belfast, 1903.

Birmingham and Midland Institute and Scientific Society. Record of Meteorological Observations. 8vo. Birmingham, 1903.

Brighton and Hove Natural History and Philosophical Society. Abstract of Proceedings for the year 1902. 8vo. Brighton, 1903.

Bristol Naturalists' Society. Proceedings. N.S., vol. x, part 3. 8vo. Bristol, 1904.

Cardiff Naturalists' Society. Transactions. Vol. xxxv. 8vo. Cardiff, 1904.

Edinburgh, Botanical Society of. Transactions and Proceedings. Vol. xxii, parts 1 and 2. 8vo. Edinburgh, 1902–3.

———. Royal Physical Society. Proceedings, session 1903–4. 8vo. Edinburgh, 1904.

Glasgow, Natural History Society of. Transactions. N.S., vol. vi, part 3. 8vo. Glasgow, 1903.

London, Geological Society of. Abstracts of the Proceedings. Session 1903–4.

———. Geologists' Association. Proceedings. Vol. xviii, parts 4–9. 8vo. London, 1904.

London, Linnean Society of. Proceedings. 116th Session, 1903–4. 8vo. London, 1904.
———. Quekett Microscopical Club. Journal. Ser. 2, vol. ix, nos. 54 and 55. 8vo. London, 1904.
———. Royal Meteorological Society. Quarterly Journal. Vol. xxx. 8vo. London, 1904.
———. ———. Meteorological Record. Vol. xxxiii, nos. 90–92; vol. xxxiv, no. 92. 8vo. London, 1904.
———. Royal Microscopical Society. Journal, 1903, part 6; 1904. 8vo. London, 1903–4.
Manchester Field Naturalists' and Archæologists' Society. Proceedings for the year 1903. 8vo. Manchester, 1904.
——— Geographical Society. Journal. Vol. xix, nos. 7–12. 8vo. Manchester, 1904.
——— Geological and Mining Society. Transactions. Vol. xxviii, parts 6–12 and 16–20. 8vo. Manchester, 1904.
——— Literary and Philosophical Society. Memoirs and Proceedings. Vol. xlviii, parts 2 and 3. 8vo. Manchester, 1904.
——— Microscopical Society. Transactions for 1903. 8vo. Manchester, 1904.
New York Academy of Sciences. Annals. Vol. xv, parts 2–4. 8vo. Lancaster, Pa., 1904.
——— State Library. Report of the Director for the year 1901. 8vo. Albany, 1902. Report . . . 1902, parts 1 and 2. 8vo. Albany, 1903.
Northamptonshire Natural History Society and Field Club. Journal. Vol. xiii. 8vo. Northampton, 1904.
North Staffordshire Field Club. Transactions. Vol. xxviii. 8vo. Stafford, 1904.
Philadelphia Academy of Natural Sciences. Proceedings. Vol. lv, part 3. 8vo. Philadelphia, 1903. Vol. lvi, parts 1 and 2. 8vo. Philadelphia, 1904.
Rochester Academy of Science. Proceedings. Vol. iv. 8vo. Rochester, U.S., 1904.
Rugby School Natural History Society. Annual Report for the year 1903. 8vo. Rugby, 1904.
Smithsonian Institution. Annual Report for the year 1901. 8vo. Washington, 1903. Annual Report . . . 1902. 8vo. Washington, 1904.
Somersetshire Archæological and Natural History Society. Proceedings. Ser. 2, vol. ix. 8vo. Taunton, 1904.
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243RD ORDINARY MEETING, 29TH MARCH, 1905, AT WATFORD.

JOHN MORISON, M.D., D.P.H., M.R.C.S., F.G.S., President, in the Chair.

Mr. Arthur Wheelwright was elected a Member of the Society.

The following papers were read:—

1. "Remarks on the Rainfall and Temperature in Hertfordshire in 1904." By John Hopkinson, F.L.S., F.G.S., V.P.R. Met. Soc., Assoc. Inst. C.E. (Printed as)

"Meteorological Observations taken in Hertfordshire in the year 1904." (*Transactions*, Vol. XII, pp. 209–216.)

"Report on the Rainfall in Hertfordshire in the year 1904." (*Transactions*, Vol. XII, pp. 217–225.)

2. "Notes on Lepidoptera observed in Hertfordshire in the year 1904." By A. E. Gibbs, F.L.S., F.R.H.S. (*Transactions*, Vol. XII, pp. 159–164.)

3. "Notes on Variation in *Melitæa aurinea* (*artemis*)." By V. P. Kitchin, B.A. (*Transactions*, Vol. XII, pp. 165–167.)

4. "Coleoptera observed in Hertfordshire in 1904." By E. George Elliman. (*Transactions*, Vol. XII, p. 168.)

5. "A Neolithic Celt found near Berkhamsted Common." By Sir John Evans, K.C.B., D.C.L., LL.D., Sc.D., F.R.S., etc. (*Transactions*, Vol. XII, pp. 157–158.)

A communication was read from Mr. E. Hartert, Director of the Tring Zoological Museum, inviting members of the Society to join the Fourth International Ornithological Congress to be held in London in June.

Mr. W. Bickerton and Mr. A. E. Gibbs were appointed delegates to represent the Society at the Congress.

244TH ORDINARY MEETING, 12TH APRIL, 1905, AT WATFORD.

JOHN MORISON, M.D., D.P.H., M.R.C.S., F.G.S., President, in the Chair.

Mr. Howard Brooks, Cedarhurst, St. Albans; Mr. Robert Grieve,

Clarence Road, St. Albans; and Mr. Benjamin Seebohm, Avenue Road, St. Albans, were proposed for membership of the Society.

The following papers were read:—

1. "Report on Phenological Phenomena observed in Hertfordshire during the year 1904." By Edward Mawley, F.R.Met.Soc., F.R.H.S., V.M.H. (*Transactions*, Vol. XII, pp. 237–244.)

2. "On some recently-exposed Beds in the Valley of the Gade, at and near Hunton Bridge." By T. E. Lones, M.A., LL.D., B.Sc. (*Transactions*, Vol. XII, pp. 253–256.)

3. "Note on the Comparative Rate of Growth of a Pedunculated and a Sessile Oak at Bayfordbury, Hertford." By John Hopkinson, F.L.S., F.G.S., V.P.R.Met.Soc. (*Transactions*, Vol. XII, pp. 245–252.)

4. "Notes on Birds observed in Hertfordshire during the year 1904." By William Bickerton. (*Transactions*, Vol. XII, pp. 226–236.)

5. "Report on the Conference of Delegates to the British Association at Cambridge in 1904." By John Hopkinson, F.L.S., F.G.S., V.P.R.Met.Soc.

As your Delegate to the Cambridge meeting of the British Association, I now report such of the proceedings of the Conference of Delegates as arose out of the representation of our Society or may otherwise be of interest to our members.

The Conference met on the 18th and 23rd of August under the chairmanship of Principal E. H. Griffiths, F.R.S. The Corresponding Societies Committee was represented, amongst others, by the following members of our Society:—Dr. H. R. Mill, Mr. F. W. Rudler (Secretary), Mr. W. Whitaker, F.R.S. (Chairman of the Committee), and your Delegate.

First Meeting.

In the Report of the Corresponding Societies Committee recommendations were made that local Societies should make it a part of their systematic work to enter upon the 6-inch Ordnance maps of their respective districts any natural features and archæological remains which are not indicated thereon; that they should assist, by scientific advice and otherwise, teachers who are anxious to introduce Nature-Study into their schools; and that they should endeavour, so far as possible, to aid the various Committees of the British Association which are appointed in connection with its several Sections.

Principal Griffiths devoted his opening address to the question of scientific education and the relation of provincial scientific societies with the British Association. He assumed that the object of these Conferences was the quickening of interest in the study of Natural Science and in the work of the British Association; stated that the general interest of the British public in science is greater now than at any former time in our history; and yet that there is urgent

need of better education in science as well as of more scientific education.

In order to bring a greater number of our local scientific Societies into touch with the British Association and also into closer connection with each other, he suggested the inclusion of a second class of societies consisting of those which do not publish the results of local investigations; and also the establishment of a 'Journal of Corresponding Societies'; concluding his Address with the following proposals:—

(1) That any Society which undertakes local scientific investigation and publishes the results may become a Society *affiliated to* the British Association.

(2) That the Delegates of such Societies shall be members of the General Committee.

(3) That any Society formed for the purpose of encouraging the study of natural knowledge, which has existed for three years and numbers not fewer than fifty members, may become a Society *associated with* the British Association.

(4) That all associated Societies shall have the right to appoint a Delegate to attend the Annual Conference, and that such Delegates shall have the rights of those appointed by the affiliated Societies, except that of membership of the General Committee.

(5) That all affiliated and associated Societies shall contribute annually the sum of at least 5*s*. for each fifty members, and that the funds thus obtained be utilized for the purpose of a 'Journal of Corresponding Societies.'

(6) That the Council of the British Association be requested to make an annual grant towards the expenses of such a Journal on the understanding that such grants should cease if the Journal became self-supporting.

In the discussion which ensued the first four of these proposals were generally approved, but doubts were expressed of the practicability of establishing a Journal.

Sir Norman Lockyer said that last year he attended the Conference chiefly to learn how the suggestion in his Presidential Address as to the formation of a great scientific organization would be received by the Delegates. He might now explain that a British Science Guild was being started, quite independently of the British Association; and it seemed to him that the Guild could work absolutely shoulder to shoulder with the Societies in the extension of their interests.

The question of the reduction of railway rates to members of scientific societies was again raised. This had already been under discussion by the Corresponding Societies Committee, and it was resolved to refer it to this Committee to consider and to take action if thought desirable.

The Rev. W. Johnson, B.Sc., representing the Yorkshire Philosophical Society, then introduced the subject of "The Utilization of Local Museums, with special reference to Schools," confining his remarks almost entirely to the natural-history side of science study. He said that: (1) a great amount of material lies *buried* in local museums; (2) it needs *proper description* and *exhibition* to make it available for the use of young students; (3) it is very desirable that *local* natural history, rather than general science, should be *illustrated* and *studied*; and he advocated the general adoption of the plan followed in the British Museum

(Natural History), where the admirable handbooks issued in each section are taken paragraph by paragraph, and each statement made in the whole description is represented by a real object by its side, so marked by coloured papers, arrows, and guiding lines that a student who works through the cases in succession follows a natural sequence of treatment under scientific guidance.

He suggested that each town should have a collection strictly limited to the natural objects which are commonly found in its neighbourhood, the flora and fauna being separate, and that in every museum there should be a large geological map of the area, with suitable vertical sections, showing the connection between the underground conditions and the variety of life on the surface; and he discussed the question whether we should take the specimens to the classes in schools, or take the classes to the specimens in the museums, expressing himself in favour of the latter alternative. All museums should, he said, be provided with meteorological instruments, and lectures should be given on the elementary laws of meteorology and the use of these instruments; and all museums should have lecture-rooms with lanterns and other appliances for demonstration. The equally important requirement of an adequate scientific library, especially of books describing and illustrating our indigenous flora and fauna, was not alluded to.

In the course of the discussion your Delegate referred to the Hertfordshire County Museum. Nearly one-half of the visitors were, he said, school children. They came in from the Board Schools during meal-times, and quickly detected any additions made to the collections. Sometimes they brought things which they had collected, such as shells, at first with the living animals in them, but they were instructed how to remove them, and were now bringing clean shells and sometimes really good specimens of the land and freshwater Mollusca of the neighbourhood. This showed how a museum would attract children and no doubt produce good educational results.

The establishment of school museums was advocated by several speakers, and the circulation amongst schools of small loan-collections was also suggested.

Second Meeting.

A Committee, consisting of Principal Griffiths, Mr. Rudler, and Mr. Whitaker, was appointed to confer with the Council as to the relations between the British Association and local scientific societies.

Principal Griffiths then vacated the chair, which was taken by the Vice-Chairman, Dr. Tempest Anderson.

Your Delegate introduced the subject chosen at his suggestion for discussion at this meeting—"The Conformity of the Publications of Scientific Societies with certain Bibliographical Requirements"—with the following remarks:—

A few years ago I suggested for discussion at our Conference the subject of Dew-ponds. We had a very interesting discussion upon

them, but I heard it remarked that it was scarcely of sufficient general interest to the Corresponding Societies.

The subject of my remarks on the present occasion should be of interest to all our Societies, and it is an eminently practical one; but I must confess that it is drier than Dew-ponds are, or should be. I will introduce it by giving a recent experience of my own, chiefly as an illustration that the title of a paper should give as clear an idea of its contents as can be given in a few words.

I am compiling, for a work to be published by the Ray Society, a Bibliography of the Freshwater Rhizopoda. I knew that in the 'Monthly Microscopical Journal,' for nine years the organ of the Royal Microscopical Society, there was a paper on a presumed freshwater rhizopod from the New Forest to which the name *Pseudo-amœba violacea* had been given, but I could not remember the title of the paper or the author's name, and the Journal has neither table of contents nor list of plates. I searched the indexes to the eighteen volumes under the catchwords "Protozoa," "Rhizopoda," "*Pseudo-amœba*," "Freshwater," and "New Forest." Under not one of these could I find a reference to the paper, and it was only by turning over the pages that the plate illustrating it caught my eye in vol. x. The paper is by Dr. R. L. Maddox, and its title is "On an Organism found in Fresh-pond Water." It is indexed under "Maddox" and "Organism" only.

There are three faults here to which I wish to draw your attention. One is the absence of a table of contents and of a list of the plates. Such a table is, or should be, very much shorter than an index, and it enables a paper on any particular subject to be found much more readily than by the index. Another is the meagre indexing; and a third is the unsatisfactory title of the paper. The newly-proposed genus does not appear in either title or index, and there is no indication of the kind of organism (believed to be a rhizopod), nor of the locality in which it was found. The title should have been something like this: "On *Pseudo-amœba violacea*, a presumed new Freshwater Rhizopod from the New Forest," and the principal words in this title, at least, should have been indexed.

I need scarcely explain how all who write similar papers, and all editors of the publications of Scientific Societies, may apply this criticism and relieve the labours of others, especially of compilers of bibliographies.

I have examined the bound volumes of most of your publications at the Office of the Association, and I find that the majority have the very serious fault that the date of publication of the several numbers or parts of which they are composed is not given. The dates may have been, and probably in most cases were, on the covers; but the covers are not bound up in the volumes, as they ought to have been—the first leaf at least—which would in most cases give date and contents, and should preferably be bound at the end of each volume. When the dates are not given in the bound volume it is impossible to ascertain when any particular paper was published, and therefore impossible to enter it in a bibliography as

it should be entered. This may be of great importance in questions of priority. The month and year of issue of each separate part of which the volume consists, with the number of the first and last page in each part, should always be printed after the title-page or table of contents and list of plates; thus, for example—

Part I, pp. 1–48... ... ... October, 1904.
,, II, pp. 49–80, ix–xvi ... January, 1905.

This might obviate the *necessity*, if not the advisability, of binding the covers.

A volume sometimes appears without an index, more often without a table of contents and a list of the plates or other illustrations. Occasionally the index is placed at the beginning of a volume; it should always be at the end. In one case at least a table of contents is called an index; in another that abomination, a collection of separate indexes, is called "indices," a term which should be restricted to its mathematical signification.

A frequent fault is the separate pagination of a thin publication, usually called "Annual Report and Proceedings," or "Annual Report and Transactions," the first part of which titles is superfluous. When, say, ten of these, of perhaps thirty pages or so each, are bound together to form a volume, how difficult it is to ascertain their contents, how difficult it would be to satisfactorily index the volume! Much rarer is the fault of making a volume so thick that it has to be bound in two.

Occasionally the name of an author is given thus: "Mr. Myth read the following paper on Sea-serpents." Initials should always be given. Occasionally the name of an author is omitted altogether. This is the case with an annual meteorological report by the Rev. W. LaTouch which appears in a very useful publication called a 'Record of Bare Facts,' issued by an energetic Corresponding Society, the Caradoc Field Club.

Now a few words about reprints. I receive one, paged 1 to 4. It is stated, on the cover only, to be from the proceedings of a certain Society, neither volume nor date being given. I wish to enter it in a bibliographical list. Reference to the publication from which it is reprinted is absolutely necessary. I cannot find it in any London library. Eventually I get the required information from the Secretary of the Society. The reprint has not only been re-paged, but the position of the type on the pages has been altered so as to get into four pages a paper running in the original into five—a great temptation certainly. But in all reprints, except reports of proceedings which would never have to be entered in a bibliography, the original pagination should be retained, and the title of the publication, the volume, and the date—month and year—should be printed on the paper as well as on the cover, so that it remains if the cover be taken off, as for binding.

There is one other point I should like to impress upon you. Your proceedings should be *published*; that is, it should be possible to purchase them. They are then amenable to the copyright laws;

copies have to be presented to five libraries—one in London, one in Oxford, one in Cambridge, one in Edinburgh, and one in Dublin. That in London is the Library of the British Museum; and even if you only print and do not publish your proceedings, a copy should be sent there. This is a point I cannot too strongly urge.

We possess, at the Office of the Association, a very valuable and unique collection of the publications of the Corresponding Societies. I hope that it will in future be kept intact, and that by more extensive and convenient premises being acquired by the Association, it may be possible to improve its arrangement and make it more accessible than it is at present; and I also think that an effort should be made to get replaced certain publications which some years ago were lent and lost, so that every paper catalogued in the Reports of the Association may be readily referred to, for some of these are not now to be found in London, not even in the Library of our greatest national institution, the British Museum.

In the discussion which ensued, Mr. Whitaker stated that he had sent some annual reports of a provincial society to the British Museum, and they were returned; and the opinion was expressed that the Trustees were acting unwisely, as such pamphlets would soon be very difficult to obtain. It was stated that they would have been gladly accepted at the Natural History Museum at South Kensington. The question of uniformity in size of the publications of scientific societies was raised, and the Vice-Chairman advocated the size of our popular magazines.

Your Delegate, in reply, said that he had excluded all reference to the size of publications because that had been considered by an influential Committee of the British Association some years ago, when demy octavo or demy quarto was recommended. He was aware that the publications of the smallest of our provincial societies would be welcomed at South Kensington, but our National Library was the one at Bloomsbury, and such publications, however small, should be there. He regretted to find that recently, in that Library, the covers of the first and the last number only of the volumes of certain scientific periodicals had been bound instead of the first cover of every number.

Reports of Delegates from various Sections were then taken.

Dr. H. R. Mill (Section A), referring to meteorological observations, instanced the Hertfordshire Natural History Society and the Croydon Natural History Society as having published each year "a most admirable meteorological report of the areas they dealt with." The Royal Meteorological Society was endeavouring to increase the interest in observation, and to direct it systematically. The subject was one of great interest; the observations were easily made; and when brought together could be put to excellent scientific use.

Mr. Whitaker (Section C) said that it was the joint desire of the Geographical and Geological Sections to determine and record the exact significance of local terms applied to topographical and

geographical objects. They should be recorded and sent to the Secretary of the British Association.

The Rev. T. R. R. Stebbing (Section D) said that a Committee of his Section suggested for investigation the following subjects:— (1) Cave faunas; (2) zoological changes on a given plot of land during the year; (3) compilation of local faunas; (4) systematic observations on the micro-organisms of a given pond or ditch; (5) overland lines of migration of birds; and (6) collection of slugs from all parts of the British Isles.

Field Meeting, 8th April, 1905.

WELWYN AND DATCHWORTH.

This was a joint meeting with the Geologists' Association, under the direction of Dr. A. E. Salter for that Association and of Mr. Hopkinson for the County Society.

On arrival at Welwyn Station at about 3 o'clock the members of the two societies walked to Datchworth by way of Harmer Green and Woolmer Green, which are situated on a Tertiary outlier owing its preservation to a capping of gravel, and it was the object of this meeting to examine this gravel in various pits.

The heterogeneous assortment of materials composing an ordinary gravel offers but small attractions to the general observer, but a geological student cannot rest satisfied until he has found a satisfactory explanation of the way in which the various constituents have been brought together and deposited in their present position, and no branch of geological enquiry has resulted in a greater difference of opinion and more lively controversy than the origin of our gravels.

A section of gravel in Mr. Powell's pit was first examined. It is stratified, varies from five to ten feet in thickness, and has false-bedded sand below it in one part of the pit. It is composed of Tertiary flint-pebbles, subangular flints, Hertfordshire conglomerate, dark chert, rough quartz blocks ranging up to four inches in length, light-coloured quartzites, banded rhyolite, jasper, grits, etc., the non-local material being chiefly Palæozoic, while Jurassic fragments, Bunter pebbles, basalt, and granite appear to be absent.

Dr. Salter's conclusions are that these and all other similar gravels in Hertfordshire were formed and deposited in exactly the same way as similar gravel is being formed and deposited to-day by the constant dissolution of chalk and other soluble matter by rain-water, leaving insoluble stony fragments which have been gradually washed away, carried by rivers often for long distances, and finally deposited by slow degrees in favourable situations. He pointed out on this occasion that the gravel occupies a rather high position in the "Drift Series" connected with the Stevenage gap, and stated that southern Hertfordshire and

northern Middlesex were formerly the meeting-ground of old streams from the north through the Stevenage gap, from the west through the Goring gap, and from the south; these uniting to form an easterly-flowing stream across Essex. The main river probably flowed southward before the existing low-lying ground of Bedfordshire had been excavated, and it brought fragments from rocks far to the north.

At Burnham Green, near the Duck Inn, some large boulders of Sarsen Stone and of Herts conglomerate were seen, and then, after passing Datchworth Church, a large pit, known as Holten's, was visited. This is upwards of ten feet in depth, and shows lines of stratification very distinctly, except where it is disturbed owing to irregular dissolution of the Chalk on which it rests. This gravel consists chiefly of Tertiary flint-pebbles, some of which are green-coated, Herts conglomerate, Bunter quartzites, quartz, and sandstone. Two unworn flints over a foot square were seen, and also frequent sandy and clayey patches. This gravel is lower in position and of more recent formation than that first visited, and differs from it in containing much Triassic material.

Returning to Welwyn Station, tea was provided at the Cowper Arms, and a vote of thanks was accorded to Dr. Salter for his exposition of the geology of the district. Most of the geological information in this report is derived from his account in the 'Proceedings of the Geologists' Association' (vol. xix, p. 108).

Field Meeting, 15th April, 1905.

FLITWICK AND SILSOE.

This field meeting, like the last, was held in conjunction with the Geologists' Association. Mr. Hopkinson, and Mr. Saunders of Luton, acted as Directors for both Societies.

In the journey north, on the Midland Railway, the Upper Cretaceous strata were passed through, and in the cuttings between Chiltern Green and Charlton the three hard beds in the Chalk—the Chalk Rock, the Melbourn Rock, and the Totternhoe Stone—were seen. On the plain beyond, the Gault was traversed, and in approaching Flitwick the outcrop of a formation better withstanding denudation—the Lower Greensand—became evident from the rising ground. The Chalk on the south, attaining a height of 800 feet, and the Lower Greensand passing through the centre of Bedfordshire, rising to 500 feet, form the two main ranges of hills in the county, and the object of this meeting was to examine sections of the latter formation.

The party assembled at Flitwick Station at about half past 3. A good section of the Woburn Sand, with its variously-coloured beds, from white to red, was seen in a pit near the railway, on the west of the line, its position appearing to be about the middle of

the Greensand. The face of the pit was "honeycombed" by the nests of sand-martins which a workman stated had arrived during the preceding week. On the opposite side of the line, north of the station, the ground is a little higher, and the highest part is capped by a bed of gravel and sand (now being removed for road-metal and garden paths), containing boulders apparently derived from the higher part of the Greensand, which has here been eroded away, and also rocks of foreign origin drifted from Palæozoic beds in the north.

Descending into the valley of the Flit, other sections of the Woburn Sand were seen, and the party then divided, the walkers, under the guidance of Mr. Saunders, crossing Flitwick Moor to Flitton and Wardhedges Quarry, and the cyclists, conducted by Mr. Hopkinson, taking the road through Greenfield and Flitton to the Castle Hill, Clophill.

Mr. Saunders reports: "The walking party visited the source of the Flitwick mineral springs. Most of the members tasted the water, which had been filtered, and it was found to be strongly impregnated with iron and vegetable acids. It has powerful medicinal properties, chiefly tonic and astringent. After passing Greenfield Mill the course led by the side of the River Flit. It was noticed from the appearance of the water that it contained iron, which was being deposited on the pebbles in the brook. It was very unlike the bright, sparkling streams which pass through the Chalk district of the south of the county." Mr. A. E. Gibbs adds: "The works are prettily situated in the midst of a plantation of birches, and are surrounded by well-kept gardens where the daffodils were flowering profusely. In the *Sphagnum*-moss of the bog that curious insectivorous plant, the round-leaved sundew (*Drosera rotundifolia*), was found in abundance. The animal life proved equally interesting, the common lizard (*Lacerta vivipara*) being seen basking in the sunshine, and the green tiger-beetle (*Cicindela campestris*), with its short, rapid, jerky flight, rising on every side as the party walked through the herbage."

On their way to Castle Hill the cyclists visited Flitwick Quarry, where the "Carstone" of the Lower Greensand is exposed. This is on a higher horizon than the Woburn Sand, and, like it, shows current-bedding. The section at Castle Hill exposes the same and the succeeding beds to the highest portion of the Greensand seen in this neighbourhood. It is of special interest, as it shows 10 feet of dark-coloured clay, called by the workmen "black clay" to distinguish it from the "blue clay" of the Gault, occurring in three distinct beds of about equal thickness with thin layers of sand between them, dark-red carstone being above the clay, and light-coloured sand beneath it. This black clay occurs at Shefford, to the east, where it has thinned to one foot, but it is not known to occur elsewhere. It is used by the workmen at the brickfields at Lower Gravenhurst, which would have been visited had time permitted, to mix with the clay obtained there from the Lower Gault. The face of the quarry in which the layers of clay are

seen, looks towards Castle Hill, and does not show cross-bedding, but behind these workings there is another quarry showing the sand and carstone apparently without the clay, and very much cross-bedded. In it, capping the Greensand, there is a thin bed of chalky boulder-clay, in which drifted specimens of *Gryphæa incurva* were found. The "doggers" and harder layers in the Greensand are here being quarried for the new water-works at Biggleswade.

The two parties then joined forces at the George Inn, Silsoe, where a good tea was provided, after which the curious "cage" in which the malefactors of the neighbourhood were formerly confined was examined, and Wrest Park, one of the seats of Lord Cowper, was visited. The walkers then returned direct to Flitwick, and the cyclists visited Wardhedges Quarry, an extensive excavation in the carstone, showing well the doggers of harder rock which owe their hardness to the infiltration of iron, and also fine examples of cross-bedding. This quarry had been previously examined by the walking party.

The cyclists then visited the site of the historical "gold-mine" in Gold Close, Pullox Hill. Some account of this mythical mine had been given by Mr. Hopkinson after tea, before the party separated. It is well known to the villagers—apparently by tradition—he had found on enquiry, that a furnace had been set up and gold was said to have been obtained, and notices of the occurrence of gold here occur in various works. Calvert, in his 'Gold Rocks of Great Britain' (1853), mentions it on the authority of Watson's 'Compendium of British Mining' (1843), where the following passage occurs:—"About 160 years since, two gold mines were stated to have been discovered; one at Pollux Hill, in Bedfordshire, and the other at Little Taunton, in Gloucestershire. The Society of Mines Royal seized them, and granted two leases of them to some refiners, who extracted some gold; but they did not go on with the work, as the gold sometimes would not repay or requite the charge of separation, though sometimes it did." Watson's quotation is from Abbott's 'Essay on the Mines of England.' This was about the year 1640; in the eighteenth century there was a report that gold had again been found near Ampthill, and it seems to have caused some excitement. Pennant, however, states that it "turned out nothing but talc," a mineral which Dr. John Woodward had previously recorded as occurring at "Pullock's Hill."

In the original Ordnance Survey Map the name of the meadow, "Gold Close," is not only given, but the actual site of the mine is located by the words "gold mine," while in the new series both these indications of the site are omitted, a revision much to be deprecated.

The cyclists rejoined the walkers at Flitwick in good time for the appointed train, just before "lighting-up time." The weather was perfect, and the country, which in the neighbourhood of Clophill is very pretty, had the freshness of the Spring with a foretaste of the leafiness of the Summer.

The following are references relating to the occurrence of gold or of talc at Pullox Hill*:—

1720. [Cox, Rev. T., and A. Hall.]—'Magna Britannia,' vol. i, p. 150.
1729. Woodward, J.—'Natural History of the Fossils of England,' vol. i, pt. 1, p. 63.
1738. *Anon.*—'Atlas Geographicus,' vol. i, p. 150.
1764. ,, 'England Illustrated,' vol. i, p. 4.
1778. Pennant, T.—'Tours in Wales,' vol. i, p. 66.
1789. Camden, W.—'Britannia,' vol. i, p. 330. (And in other editions.)
1818. Dodd, S.—'Account of the Town of Woburn,' p. 129.
1833. Abbott, G.—'Essay on the Mines of England,' p. 203.
1843. Watson, J. Y.—'Compendium of British Mining,' p. 60.
1853. Calvert, J.—'Gold Rocks of Great Britain and Ireland,' p. 101.

Field Meeting, 6th May, 1905.

MOOR PARK, RICKMANSWORTH.

This was a joint field meeting with the Selborne Society, and each Society was well represented, the Selbornians forming by far the larger number of the one hundred or so present.

By the kind permission of Lord Ebury the gardens were visited, and some of the party entered the house and inspected the fine entrance hall and other apartments on the ground floor. The Italian Garden was first seen, and afterwards, on the higher ground towards Batchworth Heath, the more rural gardens, with the lake overshadowed by fine old trees. Conifers predominate, including cedars, yews, and pines, some of very large size. One giant spruce, the central stem of which appears to have ceased growing, has spread its branches all around and rooted them into the soil, and from the nourishment thus provided have sprung up a number of small trees in a ring around their parent.

Leaving the Park, tea was partaken of at "Ye Olde Greene Manne," after which some of the party, mostly cyclists, returned direct to Watford and elsewhere, while the majority walked to Northwood Station.

The following history of the changes in the ownership of Moor Park is contributed by Mr. Daniel Hill, who acted as Director for the County Society:—

But few, if any, estates in England have passed through so many eminent hands as this.

The Manor of Moor, with several others in the neighbourhood, was conferred by Offa, King of Mercia, on the Abbey of St. Albans at the time of its foundation.

The first owner of the Manor of whom there is any record is Ralph de Boteler, Lord of Sudeley; he was made (1441) Lord Chamberlain to Henry VI, and was severely wounded at the battle of St. Albans (1454).

* Other references will be acceptable to the Editor.

The Manor then passed into the possession of George Nevil (brother of the Earl of Warwick, the King-maker); he was made Bishop of Exeter (1459), Lord Chancellor (1460), and Archbishop of York (1464), and about the year 1460 obtained a licence from Henry VI to enclose 600 acres in the Parishes of Rickmansworth and Watford, thus forming the Park, in the north-eastern portion of which he "built a stately mansion," where he lived in great magnificence. Edward IV arrested him for treason (1472); he obtained his liberty (1476), but died in that year and was buried in York Minster, the Manor thus reverting to the Crown, and so it remained until Henry VII, in the first year of his reign (1485), gave it to John de Vere, Earl of Oxford, who led the van at Bosworth-field, with remainder to the issue of his Countess, Margaret, daughter of the late Earl of Warwick and niece of Archbishop Nevil. The Earl died without surviving issue in 1513, and the estate again reverted to the Crown and appears to have been used as a Royal residence, for the Harleian MSS., 1519–1525, contain an "Inventorie of ye Gauderobe of King Henry VIII at ye Manor of ye More in the County of Herts."

There is no record of any conveyance, but about the year 1524 Cardinal Wolsey came into possession of the estate, and he greatly enlarged or rebuilt the mansion. In a letter to the King (1525) he subscribes it "at *your* Manor of the More"; a year later, a letter written to the King is subscribed as "at *my* Manor of the More"; and writing from Canterbury, 9th July, 1527, Wolsey expresses a hope that the King "will be merrie at *my* poor house of the More"; whether he was so is not stated, but in 1529 the King and Queen (Catharine of Arragon) stayed there a whole month, and Ann Boleyn was one of the party. Wolsey fell into the King's disfavour and retired to Cawood Castle, York; he was arrested for high treason, summoned to London, but died at Leicester Abbey, 29th November, 1530.

The Crown again held the forfeited estate and maintained it as a Royal residence, John Russell, first Earl of Bedford, being appointed Ranger. In 1540 Henry again visited the More with his fifth Queen, Catharine Howard. Francis, second Earl of Bedford, succeeded his father as Ranger, but, during the reign of Mary, was imprisoned for his adherence to Reformation doctrines; he escaped to Geneva. On the accession of Elizabeth he was chosen one of her Privy Councillors, and reinstated as Ranger, and she, in the eighteenth year of her reign (1576), granted the Manor, "together with the Park called Moore Park," to the said Francis Russell and his heirs at the annual rent of £120. The Earl died in 1585, and was succeeded by his grandson, the third Earl, who married the daughter of Sir J. and Lady Harrington. James I granted the estate to him, while his wife was made Lady of the Bedchamber to the Queen, but, at the death of the Queen, the Countess retired into private life and laid out the Moor Park gardens at great cost. The Earl died in May, 1627, and the Countess two or three weeks after.

William Herbert, third Earl of Pembroke, next purchased the estate; he was appointed Lord Chamberlain and Chancellor of Oxford University in 1626, and was a large contributor to Bodley's Library. Pembroke College (formerly Broadgates Hall) was named after him. He died in 1630, and was succeeded by his brother Philip, who alienated the Manor from the park. In 1631 the house and park were sold to Robert Carey, Earl of Monmouth, who died in 1639. The estate was purchased in 1663 by James Butler, first Duke of Ormond, a descendant of Ralph de Boteler mentioned before; he sold the park in 1670 and died in 1688. The purchaser was another Duke of Monmouth, a natural son of Charles II by Lucy Walters; he married the heiress of the Earl of Buccleuch and built the present mansion. He joined the Rye House plot, fled the country, conspired to invade England while Argyll attacked Scotland, landed at Lyme Regis or Totness, was defeated at Sedgemoor, captured, and sent to the Tower with his wife and children, and beheaded at the age of 36. It being proved to the King that the Duchess had always opposed her husband's disloyalty, he in 1686 made a full grant of Moor Park to her and her heirs for ever. It is said that in resentment of the treatment accorded to her husband, the Duchess had all the oak-trees in the park beheaded to unfit them for use in the Navy; colour is given to this statement by the great number of pollard oaks in the park. The Duchess sold the estate to Mr. H. B. Styles, the son of a London citizen, who amassed a large fortune by the South Sea Bubble. He set himself to improve the mansion, the front of which, under the hands of Leoni, an Italian architect, almost disappeared, for he encased it in Portland stone and added the west portico and two wings. In 1754 the estate was sold to Lord Anson, the celebrated Admiral and author of 'A Voyage round the World.' He employed "Capability Brown" to lay out the gardens, spending a very large sum on them. Lord Anson should be venerated by all Aldermen for being the first person to introduce turtle into England; he died very suddenly in 1762. Sir L. Dundas purchased the estate from Lord Anson's brother, and employed Cypriani to decorate the ceiling of the gallery; he also fitted up the celebrated lapis lazuli mantelpiece. George IV, when Prince of Wales, was sumptuously entertained by Sir L. Dundas here.

Sir L. Dundas bequeathed the estate to his son, who sold it in 1785 to Mr. Rous, who pulled down the wings, colonnades, etc., and generally did the work of a vandal; he died in 1799.

Robert Williams, a partner in the banking firm of Williams, Deacon, & Co., purchased the estate in 1801; he died in 1814 and was succeeded by his son, who laid out "the Cottage Gardens."

In 1828 Robert, second Earl Grosvenor, afterwards created Marquis of Westminster, purchased the estate; he made great alterations in the park, and on 16th June, 1833, entertained William IV and Queen Adelaide. The Marquis died in 1845, and the Marchioness the year after, and Moor Park came by inheritance to their youngest son, Lord Robert Grosvenor, who in 1847 was

created Baron Ebury. On 21st October, 1846, Queen Victoria, Prince Albert, and the Queen Dowager visited the park. His Lordship died on 18th November, 1893, and was succeeded by his son, the present Baron.

Concerning the Manor, it will be noted that Philip, Earl of Pembroke, in 1631 sold it to Sir C. Harbord, who held it for 24 years and in 1655 conveyed it to Sir R. Franklin, who in 1671 sold it to Sir W. Bucknall, from whom it came into the possession of Mr. T. S. Sotheron Estcourt, who in 1866 conveyed it to Lord Ebury. Thus the estate and Manor of Moor were again united in the hands of one owner.

Field Meeting, 20th May, 1905.

GORHAMBURY, ST. ALBANS.

By the kind invitation of our Past President the Earl of Verulam, three Societies—the Hertfordshire Natural History Society, the St. Albans and Hertfordshire Archæological Society, and the St. Albans Photographic Society—combined in a visit to Gorhambury, under the direction of Mr. C. H. Ashdown.

The Earl of Verulam received the party at the principal entrance to the mansion, and conducted his numerous visitors through the chief apartments, explaining to them, as he alone could, the interesting history of many of his treasures. The room on the right of the entrance hall, known as "Lord Verulam's Room," contains several pictures by celebrated artists, most of them having been collected by Sir Harbottle Grimston. Attention was specially directed to the portrait of Sir Nathaniel Bacon, painted by himself. "I think," said his Lordship, "that this is one of my most valuable pictures." The portraits in the hall were then examined, and the marble bust presented by Pope Ganganelli to one of Lord Verulam's ancestors, and the cinerary urn of Menelaus, were seen. In the library were pointed out the three busts in terra cotta of Sir Nicholas Bacon, Lady Bacon his second wife, and their young son Francis. In the drawing-room Queen Elizabeth's sofa, brought from the old mansion, was noticed, and in the ball-room her carpet, made entirely by hand, and containing the royal monogram. In this room is a work of great historical value, a portrait of Queen Elizabeth presented by her to Sir Nicholas Bacon after one of her visits to Gorhambury. Here also was seen a small portrait of Edward Grimstone, Ambassador to the Court of Burgundy, dating back to 1444, which, being the earliest authentic portrait of a gentleman in England, Lord Verulam said he considered to be the most valuable in his possession. The portraits mentioned above are but a tithe of those to which his Lordship directed attention, giving interesting information as to their history and sometimes amusing anecdotes of the subjects portrayed.

Before taking leave of Lord Verulam, our President, Dr. Morison,

expressed on behalf of the three Societies the indebtedness to his Lordship of all who were present for the privilege which he had accorded to them, and Lord Verulam replied that he was not certain that he was really the person to be thanked, for his visitors had given him a very pleasant afternoon.

Mr. Ashdown then conducted the party to the site of the former mansion, where he gave a history of the estate and of the residences which had been erected at Gorhambury, which he stated were four. In the reign of Henry III, the Park, he said, was in the possession of William de Gorham, then of his widow Cicely, and afterwards of John de Gorham and of Laurence de Broke, whose name was perpetuated in a clump of trees known as Broke Wood. From 1395 to the Reformation it was possessed by the Abbots of St. Albans, thus being closely connected with the history of the Abbey. At the Reformation the estate passed into the hands of the King (Henry VIII), who gave it to Ralph Rowlatt in 1541. In 1561 it was sold by Ralph Maynard, who married one of Rowlatt's daughters, to Sir Nicholas Bacon, Lord Keeper of the Great Seal. His son, Sir Francis Bacon, Viscount St. Alban, who also held the title of Lord Verulam but never of Lord Bacon, conveyed it to trustees, to the use, after his death, of Sir Thomas Meautys, who had married Sir Nathaniel Bacon's daughter, and from whom it devolved upon his brother Henry who sold it to Sir Harbottle Grimston who had married the widow of Sir Thomas Meautys. Sir Harbottle's son, Sir Samuel Grimston, bequeathed the manor and estate to his grand-nephew, William Luckyn, on condition of his taking the name and Arms of Grimston, and from him they have passed by descent to their present possessor.

The first mansion of Gorhambury was built, Mr. Ashdown said, by Robert de Gorham, an Abbot of St. Albans, in the reign of King Stephen. It was near the present lower gate lodge, and when, in 1826, the Hon. Charlotte Grimston wrote her history of Gorhambury, distinct traces were visible of a circular tower and a large quadrangle. The mansion around the ruins of which the party were assembled was built by Sir Nicholas Bacon between 1563 and 1568. The present ruins constituted only a small portion of the original house, for in front of them there had been a large courtyard with apartments on three sides of it of which not a vestage remains. Queen Elizabeth visited Sir Nicholas here in 1571, 1573, and 1577. Upon the death of his widow, Lady Ann Bacon, Gorhambury passed to Francis. It was then partly in ruins, and when Sir Francis Bacon became Lord Chancellor, in 1618, it was uninhabited. The water-supply failing, Sir Francis built a house near the Pondyards, which he called Verulam House, but he seldom resided there, preferring his London residence.

The Pondyards were then visited, and Mr. Ashdown pointed out what he believed to be the site of Verulam House.

Field Meeting, 3rd June, 1905.

ST. PETER'S, ST. ALBANS.

The party assembled in St. Peter's Churchyard and walked by way of Bernard's Heath to Beech Bottom, where, by permission of Mr. Alderman Reynolds, the old British earthwork was examined and its botany and entomology were investigated. What is known or surmised as to the origin of this earthwork having been stated in reports of previous visits to Beech Bottom, it is unnecessary to enter here into this debatable question.

The route was then by way of Soot House Lane and the lanes at the back of Marshall's Wick to the Home Wood, which was visited by permission of Mr. G. N. Marten, and the party returned to St. Albans by way of Sandpit Lane.

Here the members and their friends had been kindly invited to tea by the President of the Society and Director of this meeting, Dr. John Morison, and it was partaken of on the lawn at his residence, "Thirlstane." A vote of thanks to him and to Mrs. Morison for their hospitality concluded a very pleasant meeting.

Field Meeting, 27th June, 1905.

KEW GARDENS.

The members met at the principal entrance, Kew Green, and the Director, Mr. Daniel Hill, who has furnished this report, first called attention to the fine specimen of *Gingko biloba*, the maidenhair-tree, standing near the Tropical Fern House: it is a native of Japan, and is considered to be a survivor or very close ally of some of the plants of the Coal Measures. As its name implies, the leaves are like much-enlarged pinnæ of the maidenhair fern, but it is a conspicuous tree, nearly allied to the yews.

The Palm House was visited, and attention was called to the *Lodoïcea seychellensis*, the "coco-de-mer," noticed on our visit of 29th May, 1900 ('Trans.,' Vol. X, p. lxx), which had in the meantime been moved from the *Victoria Regia* House into the Palm House. The plant appeared to be very healthy and vigorous.

Many beautiful things were seen in the Temperate House, which covers more than two acres of ground and is believed to be the largest glass house in the world. Attention was here called to the *Strelitzia augusta*, a member of the Banana family, with its very curious flowers, much like, both in form and colour, the erected crest of an angry cockatoo. The plant was named by Aiton in honour of the Queen of George III, a member of the House of Mecklenberg Strelitz. An earlier visit to this house would well repay members to see the fine collection of Himalayan rhododendrons and camellias in flower.

Tea was partaken of at the Kiosk, and the party returned by way of the Bamboo Garden to the Rhododendron Dell and the Azalea

Garden, but though in each there was a grand show of bloom, some of the earlier varieties of both rhododendron and azalea were past their prime. In the Greenhouse many beautiful plants were noticed in flower, particularly the hybrid *Cineraria cruenta*, and fine varieties of *Schizanthus*, *Hippeastrum*, etc., and in the Orchid Houses many fine orchids. In passing a glance was given to the Succulent House, though here there was nothing special in flower, but the quaint forms of the plants themselves are quite a study.

In the Alpine House, which was last visited, there were many beautiful rock-plants in flower. This house is an unheated structure erected principally to flower under shelter the more delicate Alpines, as the Kew authorities find the smoke and fog of London very detrimental to these charming mountain plants.

Field Meeting, 1st July, 1905.

ALDENHAM ABBEY AND OTTERSPOOL, WATFORD.

The field meetings of this season, which were much more numerous than usual, and were nearly all well attended, were brought to a close this day with the most-numerously attended of any not held in conjunction with any other Society, the members and their friends numbering nearly sixty. Mr. Alfred Sutton, one of the Secretaries of the Society, acted as Director.

Aldenham Abbey was first visited by the kind invitation of Mr. J. Pierpoint Morgan, jun., who, however, was unable to be present to receive the Society, and deputed his steward, Mr. John Anderson, to represent him in his unavoidable absence.

About half the party, consisting of members from Watford, Bushey, St. Albans, Harpenden, Hertford, and Hitchin, went by train to Bricket Wood Station and walked to Aldenham Abbey under the guidance of Mr. Sutton; the rest, mostly from Watford, walked, drove, or cycled direct there. After being conducted through the beautiful gardens and grounds by Mr. Anderson, the members, assembling on a shady lawn, had tea, kindly provided by Mr. Morgan, to whom a vote of thanks was accorded on the proposition of the President, Dr. Morison.

Aldenham Abbey, in its present form, dates only from the end of the eighteenth century, when it was built by Mr. G. Woodford Thellusson on the site of an old manor-house called Wall Hall. Although the Thellusson estates were as a rule zealously kept intact under the famous Thellusson trust, this portion was sold in 1812 to Admiral Pole, and it has since passed into the hands of a succession of owners and lessees. It was never really an Abbey, though until the dissolution of the Monasteries it was held first by the Abbey of St. Albans, and afterwards by the Priory of St. Bartholomew's. The ruins which are to be seen are therefore not of ecclesiastical origin, but, like the modern house, are the product of the genius of Mr. Thellusson.

The party then, by permission of Mr. S. Taprell Holland, visited the adjacent grounds of Otterspool. The house was at one time, perhaps originally, an inn, to which persons resorted in order to drink from the famous pool in the days when "drinking the waters" was a fashionable craze. Prior to 1812 the road to Aldenham passed between the house and the river, and the existing house and beautiful gardens on the banks of the Colne were the work of the Thellussons of Aldenham Abbey. The pool, which is upwards of twenty feet deep, is perfectly clear, and the water appears of a fine blue colour. Mr. Hopkinson explained that this colour is due to its purity, as is the blue colour of the air in a clear sky; this is not because either pure water or pure air are blue, for they are colourless; it is because blue is the least refrangible of the rays of which white light is composed, and so when white light is reflected through a pure medium, the blue rays are the last to suffer absorption by refraction, the red rays first disappearing (to this the green colour of the sea is due), and then the yellow, leaving only the blue. He stated that the source of this spring had been ascribed to swallow-holes in the Chalk near Radlett, and although, as the late Rev. J. C. Clutterbuck had placed on record, there were stories of ducks having disappeared down one of these swallow-holes, reappearing in this pool, he thought it to be more likely that the water flowed out of fissures in the Chalk which extended for a long distance, gathering in their ramifications the rain-water falling over a large area. In Yorkshire the course of underground channels had been traced by colouring the water with fluorescein, and he would much like the experiment to be tried with our Hertfordshire swallow-holes when they are in action after heavy rain.

The purity of the water in this spring appeared to have been unaffected by the recent rains, or, if it had been (for the water is sometimes turbid), the effect had very quickly passed off. Not so, it may be confidently affirmed, will the pleasurable recollection of those who took part in this interesting meeting.

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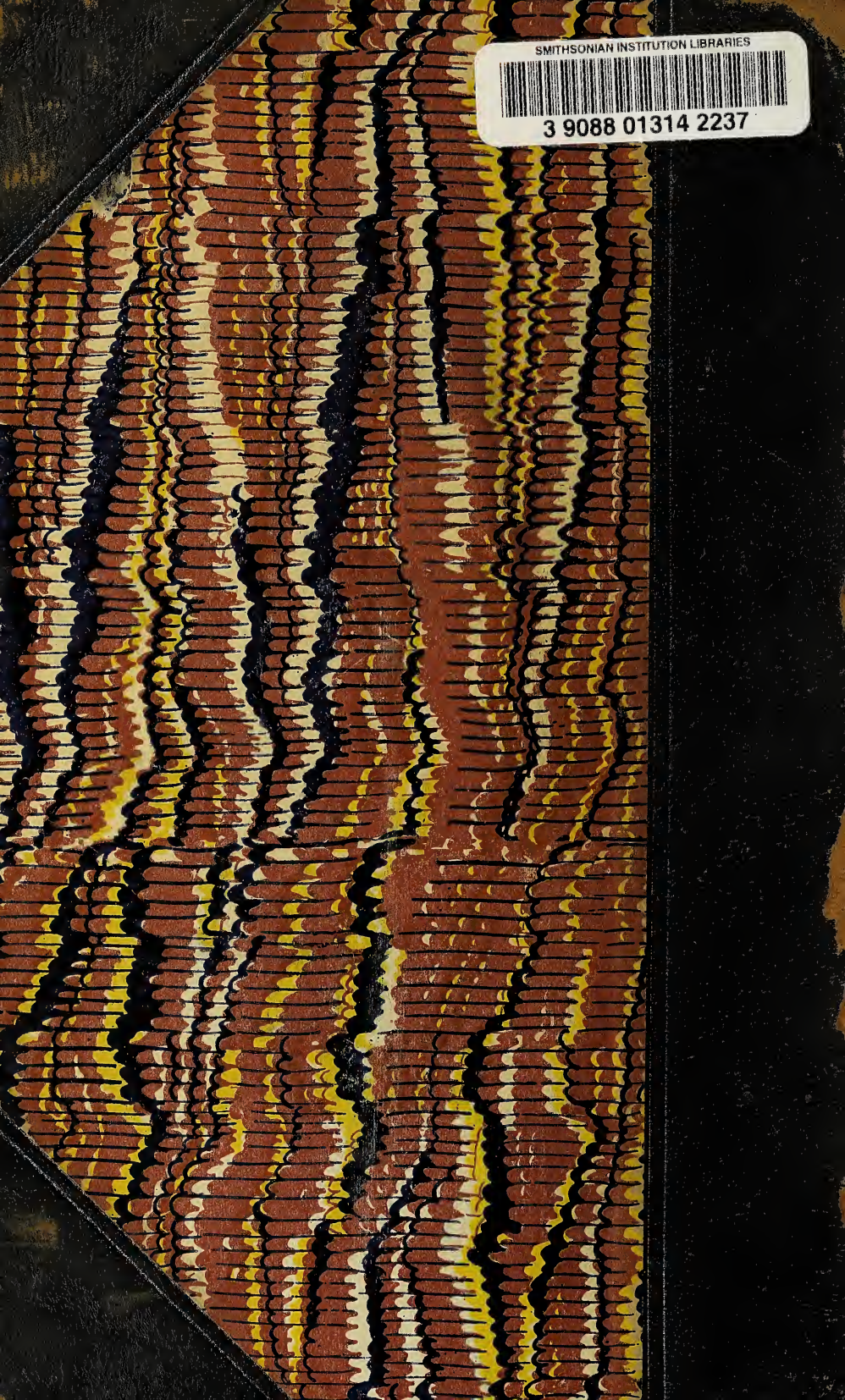
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